

## Amphibia Zambesiaca 2. Ranidae

by

J. C. Poynton<sup>1</sup> and D. G. Broadley<sup>2</sup>

### ABSTRACT

Taxonomy and distribution of members of the family Ranidae (sensu Dubois 1981) occurring in Botswana, Caprivi, Zambia, Malawi, Mozambique and Zimbabwe are detailed and discussed. Genera included are *Pyxicephalus*, *Euphlyctis*, *Tomopterna*, *Rana*, *Strongylopus*, *Hylarana*, *Hildebrandtia*, *Ptychadena*, *Phrynobatrachus*, *Nothophryne* and *Cacosternum*.

### INTRODUCTION

As stated in the Introduction to Part I of this study (Poynton & Broadley 1985), the family groupings follow those of Kluge & Farris (1969) with modifications by Dubois (1981). Our ranine genera, however, are split further than in Dubois' study. Despite recent work on the ranines (eg. Clarke 1981, Dubois 1981), there is little consensus regarding the delimitation of the genus *Rana*. A long-continued trend has been the progressive splitting away of groups formerly treated at most as subgenera of *Rana*, and we have taken this trend to its extreme as shown in the current literature. As we conceive it, *Rana* is a cold-tolerant genus, breeding in winter as well as summer in Africa, and showing an essentially nontropical distribution (in a climatic, not cartographic sense).

The other seemingly cold-tolerant ranine group represented in the Zambesiaca area is *Strongylopus*. Separating this group from *Rana* at generic level may be particularly open to criticism, but its more derived morphological features (Clarke 1981), different larval features (van Dijk 1966), and more terrestrial tendencies (Channing 1979) make it phylogenetically distinctive. It has a centre of diversity in the cool eastern highlands of South Africa, which could well be taken as its centre of origin (Channing 1979, 1981). The biogeographical features of this group are discussed further under the genus.

It has to be pointed out that the species diversity map of *Rana* and *Strongylopus* presented by Channing (1979, Fig. 34) is oversimplified in showing three species occurring along the Mozambique coast as far as Beira, and subtracting in the Zambezi Delta region. There are no records of either genus at Beira or in the Zambezi Delta. An accurate species density map would show a west to east subtraction at 20° S as species become eliminated, presumably in conformity with the topographically determined temperature gradient.

<sup>1</sup> Department of Biological Sciences, University of Natal, King George V Avenue, Durban 4001, South Africa.

<sup>2</sup> Department of Herpetology, Natural History Museum of Zimbabwe, P.O. Box 240, Bulawayo, Zimbabwe.

A fuller zoogeographical treatment is planned for Part 4 of this study, as stated in the Introduction to Part 1 (Poynton & Broadley 1985).

Literature references, locality grid references and acronyms for museum holdings which were given in Part 1 of this study are not repeated in this Part (AS—private collection of Dr Stevens, and UMMZ—University of Michigan, Ann Arbor, are additional collections examined). We wish to express our thanks to colleagues for their assistance during the preparation of this Part, especially Messrs B. T. Clarke, W. D. Haacke, A. J. Lambiris, Dr R. A. Stevens and Professor D. E. van Dijk. The final typescript was painstakingly prepared by Mrs M. E. du Plessis. The University of Natal again awarded a travel grant and a publication grant for this Part. The Natal Museum has continued to provide a full range of facilities for the project.

## SYSTEMATIC LIST

<i>Species</i>	<i>Recorded occurrence</i>						
	<i>Botswana</i>	<i>Caprivi</i>	<i>Zambia</i>	<i>Malawi</i>	<i>Mozambique</i>	<i>Zimbabwe</i>	<i>Page</i>
RANINAE							
Genus <i>Pyxicephalus</i> Tschudi							
<i>P. adspersus adspersus</i> Tschudi	●	●	●	—	—	●	122
<i>P. adspersus edulis</i> Peters	●	●	●	●	●	●	123
<i>P. adspersus angusticeps</i> Parry	—	—	—	?	●	—	123
Genus <i>Euphlyctis</i> Fitzinger							
<i>E. occipitalis</i> (Günther)	—	—	●	—	—	—	125
Genus <i>Tomopterna</i> Duméril & Bibron							
<i>T. cryptotis</i> (Boulenger)	●	●	●	●	●	●	125
<i>T. krugerensis</i> Passmore & Carruthers	●	—	—	—	●	●	127
<i>T. marmorata</i> (Peters)	●	—	●	●	●	●	129
<i>T. tuberculosa</i> (Boulenger)	—	—	●	—	—	●	130
<i>T. natalensis</i> (Smith)	—	—	—	—	●	—	131
Genus <i>Rana</i> Linnaeus							
<i>R. angolensis</i> Bocage	●	—	●	●	●	●	132
<i>R. johnstoni johnstoni</i> Günther	—	—	—	●	—	—	134
<i>R. johnstoni inyangae</i> Poynton	—	—	—	—	—	●	135
Genus <i>Strongylopus</i> Tschudi							
<i>S. grayii rhodesianus</i> (Hewitt)	—	—	—	—	●	●	136
<i>S. fasciatus fasciatus</i> (Smith)	—	—	—	—	—	●	137
<i>S. fasciatus fuelleborni</i> (Nieden)	—	—	●	●	—	—	138
Genus <i>Hylarana</i> Tschudi							
<i>H. darlingi</i> (Boulenger)	—	—	—	●	●	●	139
<i>H. lemairei</i> (Witte)	—	—	●	—	—	—	140
<i>H. galamensis</i> (Duméril & Bibron)	—	—	●	●	●	—	140

SYSTEMATIC LIST—*cont.*

<i>Species</i>	<i>Recorded occurrence</i>						
	<i>Botswana</i>	<i>Caprivi</i>	<i>Zambia</i>	<i>Malawi</i>	<i>Mozambique</i>	<i>Zimbabwe</i>	<i>Page</i>
RANINAE							
Genus <i>Hildebrandtia</i> Nieden							
<i>H. ornata ornata</i> (Peters)	—	—	●	—	●	●	141
Genus <i>Ptychadena</i> Boulenger							
<i>P. subpunctata</i> (Bocage)	●	●	●	—	—	●	143
<i>P. oxyrhynchus</i> (Smith)	●	●	●	●	●	●	144
<i>P. anchietae</i> (Bocage)	●	●	●	●	●	●	145
<i>P. obscura</i> (Schmidt & Inger)	—	—	●	—	—	—	147
<i>P. mascareniensis mascareniensis</i> (Duméril & Bibron)	●	●	●	●	●	●	148
<i>P. porosissima</i> (Steindachner)	—	—	●	●	—	●	149
<i>P. grandisonae</i> Laurent	—	—	●	—	—	—	150
<i>P. upembae</i> (Schmidt & Inger)	—	—	●	●	●	—	150
<i>P. uzungwensis</i> (Loveridge)	—	—	●	●	●	●	151
<i>P. broadleyi</i> Stevens	—	—	—	●	—	—	151
<i>P. ansorgii</i> (Boulenger)	—	—	●	—	—	—	152
<i>P. bunoderma</i> (Boulenger)	—	—	●	—	—	—	152
<i>P. taenioscelis</i> Laurent	●	—	●	●	●	—	153
<i>P. guibei</i> Laurent	●	—	●	●	●	●	154
<i>P. keilingi</i> (Monard)	—	—	●	—	—	—	154
<i>P. mossambica</i> (Peters)	●	●	●	●	●	●	155
<i>P. cotti</i> (Parker)	—	—	—	●	●	—	157
PHRYNOBATRACHINAE							
Genus <i>Phrynobatrachus</i> Günther							
<i>P. perpalmatus</i> Boulenger	—	—	●	—	—	—	158
<i>P. acridoides</i> (Cope)	—	—	—	●	●	●	158
<i>P. natalensis</i> (Smith)	●	●	●	●	●	●	160
<i>P. stewartae</i> sp. n.	—	—	—	●	—	—	163
<i>P. rungwensis</i> (Loveridge)	—	—	—	●	—	—	164
<i>P. mababiensis</i> FitzSimons	●	●	●	●	●	●	165
<i>P. parvulus</i> (Boulenger)	●	—	●	●	—	●	169
<i>P. ukingensis</i> (Loveridge)	—	—	—	●	—	—	171
Genus <i>Nothophryne</i> Poynton							
<i>N. broadleyi</i> Poynton	—	—	—	●	●	—	173
Genus <i>Cacosternum</i> Boulenger							
<i>C. boettgeri</i> (Boulenger)	●	●	●	—	●	●	174
<i>C. nanum nanum</i> Boulenger	—	—	—	—	●	—	174

## KEYS TO THE ZAMBESIACA RANIDAE

*Caution!* It is not possible to make reliable identifications on the basis of this key alone. The user is advised to check all the characters listed in the diagnoses and descriptions provided.

## Key to the genera of Ranidae

- 1 Vomerine teeth present ..... 2
- Vomerine teeth absent ..... 9
- 2 Outer metatarsals separated from rest of sole by a web, inner metatarsal tubercle not strongly flanged ..... 3
- Outer metatarsals bound into a fleshy sole, inner metatarsal tubercle strongly flanged ..... 7
- 3 Vomerine teeth lying between the internal nostrils and not abutting onto their margins ..... 4
- Vomerine teeth abutting onto anterior margins of internal nostrils .....  
**Ptychadena** (p. 142)
- 4 Length of feet not exceeding distance from tip of urostyle to arm insertion ..... 5
- Length of feet at least equal to distance from tip of urostyle to tympanum .....  
**Strongylopus** (p. 135)
- 5 No transverse skin fold or groove running immediately behind eyes ..... 6
- Transverse groove running behind eyes ..... **Euphlyctis** (p. 124)
- 6 A broad golden to brown band with a light margin running over snout and backwards over head and upper eyelids to above vent ..... **Hylarana** (p. 139)
- No broad band running from snout to vent ..... **Rana** (p. 131)
- 7 Conspicuous longitudinal light and dark bands on throat .....  
**Hildebrandtia** (p. 141)
- No longitudinal banding on throat ..... 8
- 8 Lower jaw with three sharp bony cusps ..... **Pyxicephalus** (p. 122)
- Lower jaw without sharp cusps ..... **Tomopterna** (p. 125)
- 9 A light-coloured tubercle present about midway on tarsus .....  
**Phrynobatrachus** (p. 157)
- No tubercle about midway on tarsus ..... 10
- 10 Tongue with a median papilla ..... **Nothophryne** (p. 172)
- No papilla on tongue ..... **Cacosternum** (p. 173)

Key to the subspecies of *Pyxicephalus*

Head width more than 49 % body length (ie. snout to urostyle tips of straightened specimen), maximum size up to 200 mm, commonly over 140 mm. Ventral marbling, if present, not extending well onto pectoral region .....  
**adspersus adspersus** (p. 122)

- Head width 49 % to 41 % body length, maximum size 140 mm. Ventral marbling, if present, not extending well onto pectoral region ..... **adspersus edulis** (p. 123)
- Head width less than 41% body length, at least in adults, maximum size (known from limited material) 76 mm. Ventral marbling prominent on gular and at least most of pectoral region in juveniles, but tending to fade in adults ..... **adspersus angusticeps** (p. 123)

#### Key to the species of *Tomopterna*

- 1 Inner metatarsal tubercle greater than 140 % length second toe ..... 2
- Inner metatarsal tubercle less than 120 % length second toe ..... 4
- 2 Webbing reaching middle subarticular tubercle of fourth toe and distal tubercle of fifth ..... **marmorata** (p. 129)
- Webbing not reaching middle subarticular tubercle of fourth toe and distal tubercle of fifth ..... 3
- 3 Subarticular tubercles of first finger single ..... **cryptotis** (p. 125)
- At least proximal subarticular tubercle of first finger double ..... **krugerensis** (p. 127)
- 4 Webbing terminating nearer basal subarticular tubercle of fourth toe than middle tubercle ..... **tuberculosa** (p. 130)
- Webbing terminating at or near middle subarticular tubercle of fourth toe ..... **natalensis** (p. 131)

#### Key to the species of *Rana*

- 1 Diameter of tympanum more than 50 % diameter of eye . **angolensis** (p. 132)
- Diameter of tympanum less than 50 % diameter of eye ..... 2
- 2 Width of head more than 66 % length of tibia .... **johnstoni johnstoni** (p. 134)
- Width of head less than 67 % length of tibia .... **johnstoni inyangae** (p. 135)

#### Key to the species of *Strongylopus*

- 1 Lateral body markings consist of spotting and marbling ..... **grayii rhodesianus** (p. 136)
- Lateral body markings consist of oblique stripes ..... 2
- 2 Width of head not more than 42 % length of foot . . **fasciatus fasciatus** (p. 137)
- Width of head 42 % to 50 % length of foot ..... **fasciatus fuelleborni** (p. 138)

#### Key to the species of *Hylarana*

- 1 Tips of fingers and toes expanded into distinct discs ..... **lemairei** (p. 140)
- Tips of fingers and toes not expanded into discs ..... 2
- 2 Dorsal band not bordered by a pair of skin ridges running from each eye to leg insertion ..... **darlingi** (p. 139)
- Dorsal band bordered by a pair of flattened skin ridges running from eyes to leg insertions ..... **galamensis** (p. 140)

Key to the species of *Ptychadena*

- 1 At least 2 dark bands running below vent from knee to knee .....  
**subpunctata** (p. 143)
  - One or no bands running transversely below vent ..... 2
- 2 A uniformly light triangular patch with definite base extending from eye to eye, apex at snout tip ..... 3
  - No uniformly light triangular patch on snout (if frontal area lighter, the light coloration extends posteriorly as a vertebral band) ..... 5
- 3 Snout strongly projecting, distance from nostril to tip of snout greater than internarial distance; posterior face of thigh profusely mottled .....  
**oxyrhynchus** (p. 144)
  - Distance from nostril to tip of snout not more than internarial distance; posterior face of thigh either with clearly contrasting light and dark longitudinal stripes or virtually unmarked, possessing a few indistinct light spots or lines ..... 4
- 4 Posterior face of thigh with clearly contrasting light and dark longitudinal stripes: no row of tubercles under fourth metatarsus ..... **anchietae** (p. 145)
  - Posterior face of thigh with a few indistinct light spots or interrupted lines, no darker longitudinal bands; a row of tubercles under fourth metatarsus .....  
**obscura** (p. 147)
- 5 Two (rarely up to  $2\frac{1}{3}$ ) phalanges of fourth toe free of web .....  
**mascareniensis** (p. 148)
  - $2\frac{1}{3}$  phalanges or more of fourth toe free ..... 6
- 6 Length of foot (including metatarsal tubercle) more than half body length ..... 7
  - Length of foot not more than half body length ..... 16
- 7 Posterior face of thigh spotted or mottled, not possessing continuous longitudinal bands along whole length of thigh ..... 8
  - Posterior face of thigh with clearly contrasted, continuous light and dark longitudinal bands ..... 13
- 8 Light line running along length of upper surface of tibia . **porosissima** (p. 149)
  - No light longitudinal line on upper surface of tibia ..... 9
- 9 Not more than three phalanges of fourth toe free of web ..... 10
  - More than 3 phalanges of fourth toe free of web ..... 12
- 10 Snout without skin ridges ..... **grandisonae** (p. 150)
  - Snout with skin ridges ..... 11
- 11 A pair of ridges on snout and another in interorbit; outer toe with one phalanx or less free of web ..... **broadleyi** (p. 151)
  - Pair of ridges on snout usually continuous with paravertebral pair, no separate pair in interorbit; 1 to 2 phalanges of fifth toe free of web **uzungwensis** (p. 151)
- 12 Dorsal skin folds evenly developed and none particularly prominent .....  
**ansorgii** (p. 152)
  - Paravertebral pair of skin folds particularly well developed **bunoderma** (p. 152)

- 13 Prominent, continuous dark band running transversely almost from knee to knee below vent ..... **taenioscelis** (p. 153)  
 — No continuous dark band running transversely below vent ..... 14
- 14 Mid-dorsal pair of skin folds interrupted or present only posteriorly ..... **guibei** (p. 154)  
 — Mid-dorsal pair of skin folds continuous from occiput to vent ..... 15
- 15 Less than  $3\frac{1}{2}$  phalanges of fourth toe free of web ..... **upembae** (p. 150)  
 — At least  $3\frac{1}{2}$  phalanges of fourth toe free of web ..... **keilingi** (p. 154)
- 16 Continuous paravertebral pair of skin folds from occiput at least to sacrum ..... **mossambica** (p. 155)  
 — Skin folds very interrupted, no continuous fold from occiput to sacrum ..... **cotti** (p. 157)

Key to the species of *Phrynobatrachus*

- 1 Toes expanded into small discs ..... 2  
 — Toe tips may be swollen, but not expanded into discs with usually discernable circummarginal grooves ..... 5
- 2 Broad web extending from level of distal subarticular tubercle of third toe to beyond ..... 3  
 — Webbing falling short of distal subarticular tubercle of third toe ..... 4
- 3 Dorsal skin glands weakly developed, no continuous fold from eye to scapular region ..... **perpalmatus** (p. 158)  
 — A continuous glandular fold running from each eye at least to scapular region ..... **acridoides** (p. 158)
- 4 Broad web passing proximal subarticular tubercle of fourth toe on at least one side ..... **rungwensis** (p. 164)  
 — Broad web not passing proximal subarticular tubercle of fourth toe ..... **ukingensis** (p. 171)
- 5 Broad web passing proximal subarticular tubercle of fourth toe on at least one side ..... 6  
 — Broad web not passing proximal subarticular tubercle of fourth toe ..... 7
- 6 Broad web extending to level of distal subarticular tubercle of third toe to just falling short of it ..... **natalensis** (p. 160)  
 — Broad web extending only  $\frac{1}{3}$  to  $\frac{2}{3}$  of way between subarticular tubercles of third toe ..... **stewartae** (p. 163)
- 7 Upper and lower jaws with well-marked, fairly regularly spaced light and dark barring, the barring on upper and lower jaws tending to be confluent ..... **mababiensis** (p. 165)  
 — Upper and lower jaws continually darkened or showing only faint barring mainly on upper jaw ..... **parvulus** (p. 169)

Key to the species of *Cacosternum*

- Length of foot less than half body length ..... **boettgeri** (p. 174)  
 Length of foot equal to, to more than, half body length ... **nanum nanum** (p. 174)

Genus *Pyxicephalus* Tschudi

*Pyxicephalus* Tschudi 1838: 46. Type by designation of Fitzinger 1843: *Pyxicephalus adpersus* Tschudi 1838. Dubois 1981: 248, Clarke 1981: 316.

*Phrynopsis* Pfeffer 1893: 101. Type by monotypy: *Phrynopsis Boulengerii* Pfeffer 1893.

Bullfrog. Vomerine teeth present, lying between choanae. Omosternum slightly forked, clavicles straight, transverse, approaching each other medially. Lower jaw with two large projections resembling canine teeth, and a smaller central cusp. Toes webbed. All metatarsals bound in a fleshy sole, inner metatarsal tubercle well developed and flange-like. A single gular pouch in males.

Africa south of the Sahara. Two species currently recognised, *P. obbianus* Calabresi being restricted to Somalia. A burrowing frog, forming a cocoon (Parry & Cavill 1978). Eggs are laid in water; the tadpoles are very gregarious and tend to swarm around males, which remain in the breeding pools and snap at intruders.

Populations of *P. adpersus* from more temperate areas in the south usually have a relatively broad skull and attain a larger size, which, together with more variable features of colour pattern, have been used to distinguish them from populations over the remaining African range. These features were reviewed by Parry (1982) in southern African material. Re-examination of southern African material together with material from other parts of Africa shows that the three forms recognised by Parry can be distinguished at all ages on the basis of skull width, even though markings show a complexity of geographical variation which makes them of limited value taxonomically. Parry's assignment of Zambesiaca material to three subspecies is followed in this study, although, as Parry noted, separation of material—particularly from Botswana—can be uncertain due to lack of character differentiation. It must be admitted that the taxonomic proposals followed here can be regarded only as tentative until variation over the whole African range has been thoroughly investigated.

*Pyxicephalus adpersus adpersus* Tschudi

*Pyxicephalus adpersus* Tschudi 1838: 46, 84. 'Promontorium Bonae Spei'. Syntypes in the Muséum National d'Histoire Naturelle, Paris. Boulenger 1910: 528, Power 1927: 411, FitzSimons 1930 (part) 41, Poynton 1964a (part) 93, Loveridge J. 1976: 319, Parry & Cavill 1978: 55.

*Pyxicephalus adpersus adpersus* Tschudi, Parry 1982: 285.

**Diagnosis.** Head width more than 49% body length (ie. distance between snout and urostyle tips of straightened specimen), maximum size up to 207 mm, commonly over 140 mm. Ventral marbling, if present, not extending well onto pectoral region.

**Description.** Dorsum of adult a generally uniform green to olive, no clear facial markings in adult; in juveniles facial barring tends to be obscured by light stippling. Underside usually cream to yellowish, with yellow to orange patches around axillae. Very elongated skin ridges running along length of back.

**Habitat.** Common on the Zimbabwe highveld on poorly drained clay soils, usually breeding in shallow pools, roadside borrow pits and similar situations. Presumably spending the remainder of the year buried in cocoons (Parry & Cavill 1978).



*Distribution.* South African plateau, eastern Cape, Natal, central Namibia, central and northern Botswana, extending across Zimbabwean highveld.

*Localities.* See Parry 1982: 286 for localities in Botswana and Zimbabwe. Additional localities: ZIMBABWE. Craiglee (NMZB), Mazoe (BM).

*Pyxicephalus adspersus edulis* Peters

*Pyxicephalus edulis* Peters 1854: 626. Boror, Tete, Mozambique Island. Peters 1882: 152.

*Phrynosoma boulengerii* Pfeffer 1893: 101. Quelimane. Type destroyed in Zoologisches Museum, Hamburg.

*Rana adspersa* (Bibron), Boulenger 1907b: 5.

*Rana adspersa* (Tschudi), Parker 1930: 897.

*Pyxicephalus adspersus* Tschudi, FitzSimons 1930 (part): 41 & 1939: 40, Poynton 1964a (part): 93 & 1964b: 201 & 1966: 17, Stewart 1967: 47, Stevens 1974: 1.

*Rana adspersa edulis* (Peters), Loveridge 1953a (part): 375.

*Pyxicephalus adspersus edulis* Peters, Parry 1982: 286.

*Diagnosis.* Head width 49 %–41 % body length, maximum size in populations not showing *a. adspersus* introgression, 140 mm. Ventral marbling, if present, not extending well onto pectoral region.

*Description.* Dorsum with more or less distinct olive brown, irregular blotches on a light brown to cream background. A uniform brown phase which is semi-permanent has been noted by Parry (1982). A light interorbital bar bisected by a light vertebral stripe present, usually also a light tympanic spot or inverted crescent. Clear facial banding usually present. Elongated skin ridges on back.

*Habitat.* Found on sandy substrates and areas where pools and vleis are scarce, in at least part of the Zambesiaca area. A detailed description of breeding behaviour is not yet available, but bullfrogs are reported to appear above ground only during rains (Stevens 1974) and are known to form cocoons when buried (refs in Parry 1982).

*Distribution.* Mozambique Plain and surrounding lowlands, extending across at least more northern parts of Botswana to northern Namibia and Angola; East Africa, and savannas west to Nigeria. Specimens with mixed *edulis* and *a. adspersus* traits widespread over the northern South African plateau and Botswana, upper and middle Zambesi basin.

*Localities.* See Parry 1982: 287–8 for localities in Botswana, Caprivi, Zambia, Malawi, Mozambique and Zimbabwe. Additional localities: ZAMBIA. Kabwe (BM), Petauke (BM). MALAWI. Chikwawa (AS), nr Lake Chilwa (AS), Chiromo (AS), Tuchila (AS). MOZAMBIQUE. Caia (BM), Lake Mutarara (BM). ZIMBABWE. 20 km NNW Beitbridge (NMZB), Chete Gorge (NMZB), Makado (NMZB), Ingusi (BM), 8 km S Mazunga River Bridge (NMZB).

*Pyxicephalus adspersus angusticeps* Parry

*Pyxicephalus adspersus*, var. Günther 1895: 526 (part). Shiré Highlands.

*Pyxicephalus adspersus angusticeps* Parry 1982: 289. Beira. Holotype in the Natal Museum, Pietermaritzburg.

*Diagnosis.* Head width less than 41 % body length at least in adults, maximum size (as known from two sexually mature males) 76 mm. Ventral marbling prominent on gular and at least most of pectoral region at least in juveniles, but tending to fade in adults.

*Description.* Dorsum with fairly discrete, rounded spots, tending to coincide with the dorsal skin ridges, which are more interrupted than in *a. adspersus* and *edulis*. Facial barring present.

*Habitat.* The Natal Museum type series was collected in a large reedy swamp near the Estoril camping site at Beira, along with fifteen other amphibian species.

*Remarks.* A BM specimen from 'the Shiré Highlands' (95.4.17.34), listed by Günther (1895) as *Pyxicephalus adspersus*, var., has an approximate body length of 55,8 mm and head width of 22,8 mm (exact measurement is impeded by loose skin). This gives a head width percentage of 40,9, placing it just within the range of *angusticeps*. The skin shows marbling over the pectoral region, dorsal markings (which are clearly shown) tend to be circular and to coincide with sections of the very interrupted skin ridges. The latter feature was taken by Günther to distinguish the specimen from *adspersus* and *edulis*, and in all the features just listed it agrees with *angusticeps*.

Other available Malawian material, including specimens in Dr Stevens' collection from the Shiré Highlands area, agrees with *edulis*, not *angusticeps*. Even though Günther does not specifically mention Malawi as an area visited by the collector, there seems no evident reason in Günther's paper to doubt the Shiré Highlands locality given for the specimen collected by Scott Elliott. There is no correspondence in the BM under the collector's name (Clarke, in litt.) to shed light on the route taken by Scott Elliott, such as whether he passed through Beira and could possibly have collected the specimen there. This Malawian record of *angusticeps* nevertheless evidently needs to be checked against further collections.

Günther (1895) included a specimen from 'Ugogo', collected by a Mr Baxter, in his *P. adspersus*, var. All that remains of this specimen, with a likely body length of over 150 mm, is a very damaged head, the ventral skin and portions of lateral skin, and portions of limbs. The throat and pectoral region is immaculate, and the head appears to have been broad, some 68 mm, which is about 45 % body length. This specimen, evidently collected in Tanzania, is referable to *edulis* (a meal indeed seems to have been made of it), and was incorrectly assigned by Günther to his *adspersus* var.

*Distribution.* Beira area. A Shiré Highlands record needs confirmation.

*Localities.* ?MALAWI. 'Shiré Highlands' (BM). MOZAMBIQUE. Beira (NM, NMZB), Ponte de Pungwe (NMZB).

### Genus *Euphlyctis* Fitzinger

*Euphlyctis* Fitzinger 1843: 31. Type by original designation: *Rana leschenaultii* Duméril & Bibron.  
Clarke 1981: 317, Dubois 1981: 238.

Groove-crowned Bullfrog. Vomerine teeth present, lying between the choanae. Omosternum moderately forked, clavicles straight, transverse, approaching each other medially. Toes heavily webbed. Outer metatarsal separated from rest of sole by a web, inner metatarsal tubercle elongated, narrow and sharply edged. Males with a pair of sac-like gular pouches, each pouch with small round opening near the angle of the jaw.

The current placing of *occipitalis* in the *Euphlyctis* group may require revision following more complete studies of the African and Asian ranines. At least this assignment is more acceptable than earlier placings in *Rana* and *Dicroglossus*. As Clarke (1981) has shown, *occipitalis* belongs morphologically to the *Pyxicephalus*–*Aubria*–*Conraua* section of the ranines rather than *Rana*, from which it also differs biogeographically. The convention of assigning *occipitalis* to *Dicroglossus* failed among other things to explain why Günther's description of *Dicroglossus* contained the statement, 'vomerine teeth none', while Günther's own description of *occipitalis* gave a careful account of vomerine teeth.

Bogart & Tandy (1976) have noted karyological complexity in *occipitalis*.

#### *Euphlyctis occipitalis* (Günther)

*Rana occipitalis* Günther 1858: 130. West Africa; Gambia. Syntypes in the British Museum (N.H.), London. Loveridge 1933: 361, Broadley 1971: 113.

*Diagnosis.* See diagnosis of genus.

*Description.* Females attaining a size of 135 mm (Perret 1966). A transverse skin groove running across the head immediately behind the eyes, accentuated in younger specimens by a pale line. Hands and feet recalling those of *Xenopus*, obviously associated with a markedly aquatic existence.

*Habitat.* No field data available from Zambesiaca area. A strongly aquatic savanna species.

*Distribution.* Northern Angola and Zambia to Sudan, west to Senegal.

*Localities.* ZAMBIA. Munwa (NMZB), Niamkolo (Loveridge 1933).

#### Genus *Tomopterna* Duméril & Bibron

*Tomopterna* Duméril & Bibron 1841: 443. Type by designation of Boulenger 1918: *Pyxicephalus delalandii* Tschudi 1838. Dubois 1981: 251, Clarke 1981: 318.

Burrowing frogs, Sand frogs, Pyxies. Vomerine teeth present, lying between the choanae. Omosternum slightly to moderately forked. Clavicles straight, transverse, approaching each other medially. Toes webbed. All metatarsals bound in a fleshy sole, inner metatarsal tubercle well developed and flange-like. A single, weakly developed gular pouch in males.

Africa south of the Sahara to India. The members of this genus are strong burrowers with a short aquatic phase, allowing them to become a dominant element in arid areas, but they are also a conspicuous element in moist regions. Eggs are laid in water.

#### *Tomopterna cryptotis* (Boulenger)

*Rana cryptotis* Boulenger 1907: 109. 'Catequero, Ponang Kuma (Dongwenna), Kafitu Swamps', Angola. Syntypes in the British Museum, London.

*Pyxicephalus delalandii*: (non Tschudi), Boulenger (part) 1910: 528, Power 1927: 412 (non Duméril & Bibron), FitzSimons 1935: 387.

*Pyxicephalus delalandei cryptotis* (Boulenger), Poynton 1964a (part): 96 & 1964b: 201, Stewart 1967: 49.

*Pyxicephalus delalandii cryptotis* (Boulenger), Broadley 1971: 112.

*Tomopterna delalandei cryptotis* (Boulenger), Stevens 1974: 6.

*Diagnosis.* Infratympanic gland tending to form a continuous ridge. Subarticular tubercles of first finger single. Inner metatarsal tubercle more than 140 % length of

second toe. Webbing not reaching middle subarticular tubercle of fourth toe, and incised further than distal tubercle of outer toe.

*Description.* Males not usually exceeding 42 mm, females usually not more than 50 mm. Stocky build, length of tibia subequal to width of head, at least in males. A dark interocular bar with posterior projection usually present, sometimes leading onto a light occipital patch, and often bisected by a light line from snout to vent. A pair of dorsolateral light lines sometimes present, continuous or broken.

*Habitat.* Common in the Kalahari and lowland areas further east, especially where there are sandy substrates. Breeding in shallow pools or rivers with sandy beds and in pans.

*Remarks.* Poynton (1964a) noted a difference in call between *cryptotis* and *delalandii* Tschudi, although external differences were very slight. The forms were treated as subspecies on the grounds that they were allopatric and showed some apparent intergradation. Sympatry has not yet been demonstrated on the basis of calling, but morphological evidence of intergradation is now rendered uncertain by the great similarity between *cryptotis* and *krugerensis* (see under that species). Treating *cryptotis* and *delalandii* as separate species, as in Passmore & Carruthers (1979), seems justified on the grounds of different calls, and serves to underline the taxonomic differences between the Cape and tropical faunas (Poynton & Broadley 1978).

*Distribution.* Widespread in the drier sub-Saharan savannas. Absent from much of Natal and the southern and southwestern Cape. Apparently uncommon in Mozambique; more abundant to the west, and the commonest frog in Namibia.

*Localities.* BOTSWANA. Bokspits (NMZB), Boro River (TM), Chief's Island (TM), 13 km W Foley (NMZB), Four Rivers Camp (NMZB), Francistown (NMZB, TM), 64 km NW Francistown (NMZB), Gaborone (NMZB, TM), 8 km W Gaborone (NMZB), Ghanzi (BM), 51 km W Kanye (NMZB), Kgaotwe Pan (TM), Kwikampa (NMZB), Khunwane Borehole (TM), Khwai River (NMZB), Ky Ky (TM), Lobatse (MM), Magogophate Game Camp (NMZB), Mahalapye (NMZB), Mahupa (TM), Masalanyane (NMZB), Maun (NMZB), Maxwee (NMZB), Metsemotlhaba River (TM), Nokaneng (TM), 8 km S Nata (NMZB), 10 km S Nata (NMZB), Pom Pom (NMZB), Serowe (AM), Sikwane (NMZB), Titumi (TM), 40 km S Tsau (NMZB), Vloorskop (NMZB), Xaxaba (NMZB). CAPRIVI. Katima Mulilo (NMZB), 15 km WSW Katima Mulilo (TM). ZAMBIA. Chilola River, Chipeto (BM), Chipata (NMZB), Kalabo (AMNH), Kalomo River (AMNH), Livingstone (AMNH, NMZB), Sandaula Plain (NMZB), Sesheke (NMZB), Victoria Falls (NMZB). MALAWI. Salima (NMB), 'Matope, the Lake Chilwa floodplain, Zomba, Tuchila and Mikolongwe districts' (Stevens 1974). MOZAMBIQUE. Beira (NM), Bela Vista (DM), Chigubo (TM), 15 km SW Magude (TM), 8 km E Mapulanguene (TM), Morera (NMZB), 50 km N Mutarara (BM), 10 km SSE Ressano Garcia (NMZB). ZIMBABWE. Antelope (NM), Beatrice (NMZB), Bembezi (NMZB), Bulawayo (NMZB), 23 km NNW Bulawayo (NMZB), 27 km NE Bulawayo (NMZB), Caterpillar Pan, Hwange N.P. (NMZB), Changadzi Bridge (NMZB), Chinhoyi (TM), Chivake River Bridge (NMZB), Empress Mine (NMZB), Esigodini (NMZB), Fatima (NMZB), Gulati C.A.

(NMZB), Gwebi Agricultural College (NMZB), Gweru (NMZB), Inyati T.T.L. (NMZB), Irisvale (NMZB), Kazungula Ranch, Zambezi River (NMZB), Kwekwe (NMZB), Linkwasha, Hwange N.P. (NMZB), Linslade Farm, Lalapanzi (NMZB), Longueville Ranch (NMZB), Lundi River Bridge (NM), Lupane (NMZB), Lusulu, Binga (NMZB), Makado (NMZB), Maleme Dam (NMZB), Malikango (NMZB), Matendere Ruins (NMZB), Mount Hampden (NMZB), Mutoko (NM), Mupudzi Bridge (NMZB), Neshuru, Malibi (NMZB), Nottingham Ranch (NMZB), Nyakasikana (NMZB), Old Umtali (NMZB), Sengwa Gorge (NMZB), Shashi/Shashani Confluence (NMZB), Teaklands (NMZB), Umgusa River Ranch (NMZB), Umshandige River, Masvingo (NMZB).

### *Tomopterna krugerensis* Passmore & Carruthers

*Tomopterna krugerensis* Passmore & Carruthers 1975: 32. Machayipan, Kruger National Park, Republic of South Africa. Holotype in the Transvaal Museum, Pretoria.

*Pyxicephalus delalandei cryptotis* Poynton 1964a (part): 96 (Bela Vista & Mkuze Reserve records).

**Diagnosis.** Infratympanic gland tending to form a continuous ridge. At least the proximal subarticular tubercle of first finger double (see Remarks). Inner metatarsal tubercle more than 140 % length of second toe. Webbing usually not reaching middle subarticular tubercle of fourth toe, incised to base of distal tubercle of outer toe or more deeply.

**Description.** Males not usually exceeding 48 mm, females not exceeding 55 mm. Stocky build, length of tibia subequal to width of head, at least in males. A dark interocular bar with posterior projection usually present, occasionally leading onto a light occipital patch and occasionally bisected by a light line from snout to vent. Dorsolateral light lines only very rarely present. Palmar subarticular tubercles tending to be doubled at least on first finger (see Remarks).

**Habitat.** Savanna, typically sandveld, breeding in pans and vleis.

**Remarks.** In the same way that a difference in call led to the separation of *T. delalandii* and *cryptotis* despite very slight external differences when variation is taken into account (see under *cryptotis*), so *krugerensis* has been established mainly on call. Passmore & Carruthers (1975) separated *krugerensis* morphologically from *cryptotis* and *marmorata* on its possession of doubled or at least divided subarticular tubercles on the first finger, and in having its extent of webbing intermediate between *cryptotis* and *marmorata*. It was stated to differ from *marmorata* (but to resemble *cryptotis*) in the continuous infratympanic gland, and to differ from *cryptotis* in not having light vertebral and dorsolateral lines, a fairly common feature in *cryptotis*. A vertebral line is in fact present on one of the paratypes (TM 29546), and is present in other series. The dorsolateral pair of lines does occur as a rarity. *T. krugerensis* was noted to be greater in body length than *cryptotis*, and especially where the two species have been collected at the same breeding site (Naboomspruit, Passmore 1976, and Eenhana, R. van den Berg pers. comm.) the size difference is clear.

None of these morphological features can decisively separate *krugerensis* from *cryptotis*. We have taken the condition of the palmar tubercles to be the main diagnostic feature, but variation ranges from single to divided to doubled tubercles

in a single series and a single individual can have divided tubercles on the one hand but not the other. As this variation was not treated by Passmore & Carruthers, some indication of the complexities is given here.

The following table shows the variation in a series of 32 NMZB specimens from Malugwe Pan, about 120 km NE of the type locality.

<i>Condition of tubercles</i>	<i>No. of individuals</i>	<i>%</i>
Double on fingers 1 to 3	2	6
Double on fingers 1 & 2, partly 3	2	6
Double on fingers 1 & 2	10	31
Double on fingers 1 & partly 2	8	25
Double on finger 1	4	13
Double on part of finger 1	6	19

This breakdown into classes can only be superficial, because some specimens have different conditions on each hand. Webbing does not conform to this grouping: in the specimen where doubling is least distinct, the webbing is less incised (ie. less like *cryptotis*) than one of the specimens with doubled tubercles on three fingers. It might be noted that in this series the webbing between toes 1 to 4 is very full, matching the illustration of *marmorata* in Passmore & Carruthers (1975 Fig. 5), but the main margin fails to reach the distal tubercle of the fifth toe, so matching *cryptotis* in their figure.

A similar range of variation is shown in a series of 12 specimens from Sazale Pan, about 10 km west of Malugwe Pan, although one specimen shows virtually no division of any tubercles. The same range of variation is shown in the type series.

NMZB and NM series from Beira contain individuals with single tubercles, apart from one NM specimen with a double proximal tubercle on the first finger of one hand only, and a NMZB specimen with both proximal tubercles doubled. It seems artificial to split the series on the basis of tubercles in such cases, especially as the NM specimen becomes unclassifiable. The material is therefore referred to *cryptotis*, and a similar procedure is adopted with *marmorata* (see under that form). The Beira material suggests, however, that more typical *krugerensis* occurs in that area.

The difficulties encountered in separating *krugerensis* from *cryptotis* are repeated in *marmorata* material. Sixteen specimens from Mahenya, Chipinge, show the same range of variation in palmar tubercles as the Malugwe Pan series, and are referred to *krugerensis*; another 16, collected at the same time, are referred to *marmorata*. As a whole they differ from specimens referred to *krugerensis* only in that the finger tubercles are not divided, since the range of variation in webbing allows no separation on this character. Nine of these specimens show a tendency towards lack of contrast between light and dark markings, and an overall reddening in addition allows immediate recognition as *marmorata*. But specimens that do show markings have the same patterning as specimens referred to *krugerensis*, making specific separation on the basis of palmar tubercles appear precarious (see under *marmorata*).

In our present state of knowledge, it seems that separation of *krugerensis*, *cryptotis* and *marmorata* can only be done with confidence in an actual breeding situation in the field, the calls (as far as is known) being quite distinctive. The

possibility of yet more cryptic species has to be borne in mind, however, especially in view of described variations in ploidy (Bogart & Tandy 1976).

*Distribution.* Known from sandy areas of north-eastern Natal (Mkuzi Reserve) and southern Mozambique across to northern Namibia and southern Angola (Col-equero). Probably occurring at Beira (see Remarks).

*Localities.* BOTSWANA. Ghanzi (BM), Kangyane Pan (NMZB), 51 km W Kanye (NMZB), 8 km S & 55 km W Nata (NMZB), Toteng (NMZB), 8 km S Tshane (NMZB), Tshilonyane (NMZB). MOZAMBIQUE. Bazaruto Island (NM, NMZB, TM), Beira (NM, NMZB), Bela Vista (DM), Chigubo (TM), 8 km E Mapulanguene (TM), Matchova (NMZB), Nova Sofala (NMZB). ZIMBABWE. Fishan (NMZB), Hippo Valley (NMZB), Lupane (NMZB), Mahenya (NMZB), Malugwe Pan (NMZB), Marhumbini (NMZB), Mpakati (NMZB), Nyamugwe Pan (NMZB), Sabi/Lundi Confluence (NMZB), Sazale Pan (NMZB).

### *Tomopterna marmorata* (Peters)

*Pyxicephalus marmoratus* Peters 1854: 627. Boror, Mozambique. Holotype in the Zoologisches Museum, Berlin. Poynton 1964a: 99 & 1964b: 201 & 1966: 18, Stewart 1967: 51, Broadley 1971: 112. *Arthroleptis rosei* Hoffman 1944: 174, figs. 1–4. 'Chitalia', ie. Chitala River, Malawi. Holotype in the National Museum, Bloemfontein.

*Diagnosis.* Usually no prominent infratympanic ridge apart from a streak behind angle of jaw. Subarticular tubercles of first finger single. Inner metatarsal tubercle more than 140 % length of second toe. Webbing reaching middle subarticular tubercle of fourth toe on at least one side, not incised further than distal tubercle of outer toe.

*Description.* Males not exceeding 45 mm, females not exceeding 55 mm. Stocky build, length of tibia subequal to width of head, at least in males. Usually no clearly contrasting light and dark patterning, sometimes with a darker interocular bar and/or lighter occipital patch, but no light longitudinal lines. Ground colour often with orange to red tinge.

*Habitat.* Savanna rivers, streams or ponds, especially those with a sandy substrate.

*Remarks.* A single specimen from Chiredzi is referred to this species, although on its left first finger the proximal subarticular tubercle is double, a feature of *krugerensis*. All tubercles are single on the right hand. The same complication occurs with specimens referred to *cryptotis* (see under *krugerensis*). The dorsal coloration is indefinite red-grey, with no distinct markings, and webbing falls within the range of variation of both *krugerensis* and *marmorata*. Short of referring one half of the frog to *krugerensis* and the other half to *marmorata*, a specimen such as this can only serve to make the point, once again, that identification in the *marmorata*–*krugerensis*–*cryptotis* complex may require more data than can be supplied by external features of a single preserved specimen.

*Distribution.* Known from north-eastern Natal, eastern Transvaal, Zimbabwe, and apparently restricted ranges in Botswana, Zambia, Malawi and Mozambique. Probably occurring further north, but confused in the literature with *cryptotis*.

*Localities.* BOTSWANA. Mosetse Bridge (NMZB), Titumi (TM). ZAMBIA. Balmoral Farm (NMZB), Chipata (NMZB), Livingstone (NMZB), Sayiri Court

(NMZB). MALAWI. Chitala River (NMB). MOZAMBIQUE. Boror (ZMB), Magasso (NMZB), Tete (NM). ZIMBABWE. Binga C.L. (NMZB), Buffalo Bend (NMZB), Buffalo Range (NMZB), Charara Confluence, Kariba (NMZB), Chinhoyi (NMZB), Chipinda Pools (NMZB), Chiredzi North (NMZB), Chirivira Falls (NMZB), Chisumbanje (NMZB), Chivake River Bridge (NMZB), Chizarira Game Reserve (NMZB), Elim Mission (NMZB), Empress Mine (NMZB), Fatima (NMZB), Fishan (NMZB), Gokwe (NM, TM), Gokwe/Sanyati C.H.A. (NMZB), Gwai River (NMZB), Irisvale (NMZB), Jalopi River (NMZB), Kaitano (NMZB), Kapami (NMZB), 8 km SE Kapami (NMZB), Kariba (BM, NMZB), Kasane (NMZB), Katombora Rapids (NMZB), Kotwa (NMZB), Linslade Farm (NMZB), Longueville Ranch (NMZB), Lundi River Bridge (NM), Lutope Gorge (NMZB), Mabalauta Field Station (NMZB), Magasso (NMZB), Mahenya (NMZB), Main Camp, Hwange N.P. (NMZB), Makado (NMZB), Maleme Dam (NMZB), Malikango (NMZB), Mangwe Pass (NMZB), Manzituba Camp (NMZB), Matendere Ruins (NMZB), Matetsi River Bridge (NMZB), Matopos (SAM), Matusadona N.P. (NMZB), Mkota C.L. (NMZB), Msoro (NMZB), Mutoko (NM), 55 km NE Mutoko (NMZB), Musirizwi River (NMZB), Mupudzi Bridge (NMZB), Murewa (NMZB), Mutare (NM), Namakurwe River (NMZB), Ngezi (NMZB), Nuanetsi (NMZB), 5 km W Nyampanda (NMZB), Odzani River (NMZB), Odzi (NMZB), Ranelia (NMZB), Rukomeshe Research Station (NMZB), Runde C.L. (NMZB), Sengwa Gorge (NMZB), Sentinel (NMZB), Shashi/Shashani Confluence (NMZB), Siantamba (NMZB), Silalabuhwa, Insiza C.L. (NMZB), Sinyanje (NMZB), Teaklands (NMZB), 13 km SE Tsholotsho (NMZB), Tsungwesi (NMZB), Tuli (NMZB), Umfuli River, Beatrice (NMZB), Usher Institute (NMZB), Van Niekerk's Ruins (NMZB), Victoria Falls (TM), Westwood (NMZB), Whitewaters, Mutare (NMZB), Zambezi/Matetsi Confluence (NMZB).

### *Tomopterna tuberculosa* (Boulenger)

*Pyxicephalus rugosus* Günther 1864: 479, pl. 33, fig. 1. Pungo Andongo, Angola. Holotype in the British Museum (N.H.) London.

*Rana tuberculosa* Boulenger 1882: 30 (new name, *R. rugosa* preoccupied by *rugosa* Schlegel).

*Pyxicephalus tuberculosus* (Boulenger), Poynton 1964a: 100 & 1964b: 202, Stewart 1967: 53, Broadley 1971: 113.

**Diagnosis.** Infratympanic gland tending to form a continuous ridge. Subarticular tubercles of first finger single. Inner metatarsal tubercle not more than 110 % length of second toe, usually less than length. Webbing terminating nearer basal subarticular tubercle than middle tubercle of fourth toe, falling far short of distal tubercle of outer toe.

**Description.** Males not exceeding 40 mm in Zambia, apparently less in Zimbabwe, females not known to exceed 45 mm. Fairly stocky build, length of tibia subequal to greater than width of head in males. A light interocular bar formed by an anterior dark bar in addition to the more posterior dark bar, usually bisected by a light line from snout to vent. Conspicuous, symmetrically placed dark margins on a grey-brown ground, usually overlying warty ridges and outlined by a line of small tubercles. In Angola and Namibia, there is a range in coloration from the typical *tuberculosa* markings to a uniform brown. No uniformly coloured specimens have



yet been found in Zimbabwe or Zambia, but the possibility of brown, unmarked individuals occurring in this area should be borne in mind.

*Habitat.* Open savanna, tending to breed in shallow pools and pits rather than in streams.

*Distribution.* Mainly upland areas of Zimbabwe, Zambia, Tanzania, Zaïre, Angola, Namibia.

*Localities.* ZAMBIA. Chilongowelo, Mbala (BM, NMZB), Chipangali (NMZB), Mambwe (PEM), Ndundu, Mbala (BM, NMZB), Sayiri Court (FMNH, NMZB), Serenje (NMZB). ZIMBABWE. Chivake River Bridge (NMZB), Dhlodhlo Ruins (NMZB), Gonakudzingwa Koppies (NMZB), Harare (NMZB), Marondera (MM), Matopos N.P. (NMZB), Mhangura (BM, NMZB), Mrewa (NMZB), Mutoko (NM), Nyazura (NMZB), Retreat Farm (NMZB), Rukute Farm (NM), Sote Source (NMZB), Zimunya Township, Mutare (NMZB).

### *Tomopterna natalensis* (Smith)

*Pyxicephalus natalensis* Smith 1849: 23. 'Eastward of the Cape Colony'. Probable holotype in the British Museum (N.H.), London. Poynton 1964a: 101.

*Diagnosis.* Infratympanic gland tending to be reduced to a ridge between tympanum and axilla. Subarticular tubercles of first finger single. Inner metatarsal tubercle not more than 110 % length of second toe, usually less than length. Webbing not to just reaching middle subarticular tubercle of fourth toe, reaching (sometimes falling short of) distal tubercle of outer toe.

*Description.* Males not normally exceeding 34 mm, females not normally exceeding 39 mm. Relatively slender build, length of tibia exceeding width of head in both sexes. A darker interocular bar and somewhat asymmetrical marbling, with no light longitudinal lines. Usually with a pair of paravertebral dark spots in the scapular region and scattered black spots posterior to the sacrum.

*Habitat.* Typical of small streams without much cover, but also occurring in open pans.

*Distribution.* Southern Mozambique, Transvaal, Natal, eastern Cape.

*Localities.* MOZAMBIQUE. Estatuane (NMZB), Namaacha (DM, NMZB).

### Genus *Rana* Linnaeus

*Rana* Linnaeus 1758: 210. Type by designation of Fitzinger: *R. temporaria* Linnaeus. Clarke 1981: 319, Dubois 1981: 249.

True Frogs. Vomerine teeth present, lying between the choanae. Omosternum entire, clavicles straight, transverse, approaching each other medially. Length of foot not exceeding distance from tip of urostyle to axilla. Toes well webbed. Outer metatarsal separated from rest of sole by a web, inner metatarsal tubercle compact and small. A single, weakly developed gular pouch in males.

See discussion of the family Ranidae regarding delimitation of the genus *Rana* in this study. As here conceived, the genus occurs mainly in the higher latitudes and altitudes (ie. cooler areas) of Africa, extending into north temperate areas. Eggs laid in water.

*Rana angolensis* Bocage

*Rana angolensis* Bocage 1866: 73. Duque de Bragança, Angola. Type destroyed in the Museu Bocage, Lisbon. Boulenger 1902: 15 & 1907b: 5 & 1918b: 131, Parker 1930: 897, FitzSimons 1939: 40 & 1958: 212, Poynton 1964a: 103 & 1964b: 202 & 1966: 18, Stewart & Wilson, 1966: 298, Stewart 1967: 53, Broadley 1971: 113, Stevens 1974: 6.

*Rana nyassae* Günther 1893: 558. Shiré Highlands, Malaŵi. Holotype in the British Museum, London. *Rana nutti* Boulenger 1896: 467. Lake Tanganyika. Syntypes in the British Museum, London. Parker 1930: 897.

*Rana fuscigula angolensis* Bocage, Loveridge 1953a: 365 & 1953b: 147.

*Rana fuscigula fuscigula*, Loveridge (not Duméril & Bibron) 1953a: 336.

**Diagnosis.** Head width/tibia length not more than 0,68; head width/foot length not more than 0,60; tympanum/eye more than 0,50.

**Description.** Size variable, females attaining 90 mm in some localities (Malaŵi mountains), but usually not more than 70 mm. Head fairly acutely to obtusely pointed, large tympanum, heavily webbed feet (1 to 2 phalanges of 4th toe free). Legs relatively long. Skin with longitudinal ridges, variable in development (see Remarks). Dorsal surface of breeding males tending to be covered with whitish spines. Ground colour varying from green to brown, usually with dark rounded or square spots, and often with a light band from snout to vent. Gular region almost immaculate to heavily marbled, more so in females, when it may extend to the belly.

**Habitat.** Within its distribution range, it is the 'common frog' where there is permanent water combined with vegetation cover on the banks. Given these conditions, it ranges from forest to grassland.

**Remarks.** Laurent (1972) regards *chapini* Noble as a subspecies of *angolensis*, a ranking that may prove to be justifiable, but not, we believe, on the small amount of data Laurent actually presents. He considers only the shape of the snout, which is a very variable feature (cf. Parker 1930), and presents measurements based on only nine Shaba specimens of *angolensis*. A detailed assessment of the variation in *angolensis* is certainly needed, but its success presupposes wide geographical sampling. Geographical variation in skin ridging has been noted by Poynton (1964a), who drew attention to the fact that the common practice of synonymising *angolensis* with the South African *delalandii* Duméril & Bibron was based on the untested presupposition that such geographical variation is clinal. Angolan material is characterised by a pair of prominent skin ridges, running from the upper eyelid to above the leg insertion. These ridges are usually continuous, although a single series may have individuals with branched or broken ridges (eg. TM 23973–77, Humpata). Development of these ridges is not a feature of South African material, which tends to have the ridges broken and less prominent.

The geographical connection between Angolan and southern African populations lies in the uplands of the Zambezi–Zaire divide (*angolensis* does not occur in Namibia or most of Botswana), and in this area the paravertebral ridges tend to become discontinuous and less prominent. In a PEM series of fourteen adults from Mbala, the ridge is discontinuous on at least one side in five specimens. This tendency becomes more marked to the east, and in Malaŵi, continuous ridges are a rarity. This breaking up of the ridges continues down southern Africa, and it seems justifiable to accept Boulenger's use of *angolensis* as the first available synonym for

*delalandii* D. & B., which was made a homonym by *Pyxicephalus delalandii* Tschudi being placed in *Rana* (Poynton 1964a).

Poynton (1964a) also noted that the types of *angolensis* differed from South African *delalandii* D. & B. in their extensive ventral mottling. In this feature, clinal variation is also shown, but in this case the change occurs not so much on an east-west axis (some Malaŵi series show as much ventral mottling as Angolan material), but a north-south axis, material south of Malaŵi becoming progressively less mottled.

In view of such wide-ranging variation in *angolensis*, a meaningful assessment of *chapini* needs to be based on a more comprehensive survey than is presently available.

**Distribution.** Mainly upland areas of Ethiopia south to Shaba (as *chapini* and *nutti*), Angola east to Mozambique, most of South Africa excluding the southwestern Cape.

**Localities.** BOTSWANA. Kanye (NMZB), Lobatse (MM). ZAMBIA. Chilogwelo (BM, FMNH), Chipata (NMZB), Chunga (NMZB), Ikelenge (NMZB), Kabompo (NMZB), Kachalola (AMNH), Kalichero (NMZB), Katete/Lupande (NMZB), Lake Chila (FMNH), Lumi River, Mbala (BM), 6 km E Lusaka (BM), Mambwe (NMZL), Mbala (BM, NMZL, PEM), 11 km NNE Mpika (NMZB), 11 km SSE Mpulungu (NMZB), Niamkolo (BM), Nyika Plateau (AMNH, NMZB), Petauke (BM), Petauke Old Boma (NMZB), Sakeji (NMZB), Senje Hill (NMZB), Sitwe (NMZB). MALAŴI. Blantyre (AJL), Chambe Plateau (NMZB), Chikwawa (TM), Chisambo Estate (NMZB), Lilongwe (NMZB), Livingstone (BM), Lujezi (NMZB), Madzeka Basin (NMZB), Misuku Hills (East) (NMZB), Misuku Village (NMZB), Mulosa (JV), Nkhata Bay (NMZB), Nkwadzi Hill (NMZB), Ruvo Gorge (NMZB), Somabani Basin (NMZB), Thyolo (TM), Zomba Plateau (BM, TM). Misuku Mountains; Nyika Plateau; Nchenachena; Ntchisi Mountain; Chitala River; Chiradzulu; Limbe; Thyolo Mountain; Likabula River; Chowe ( Loveridge 1953a); Limbe/Mulanje ( Loveridge 1953b); Chisenga; Rumpi; Livingstonia; Mzuzu; Chikangawa (Stewart 1967). MOZAMBIQUE. Amatongas (BM), Chemezi (NMZB), Chinamainza (NMZB), 19 km S of Erego (NMZB), Espungabera (NMZB), 6 km S of Estatuane (NMZB), Fermerenga (NMZB), Garuso (NMZB), Gondola/Gorongozo Pontoon (NMZB), Gorongozo Mountain (NMZB), Lower Revue Bridge (NMZB), Maforga (NMZB), Makurupini Valley (NMZB), Martins Falls (NMZB), Matareca (NMZB), Meponduine (NMZB), Mitucué Mountain (NMZB), Moamba (TM), Namaacha (DM, NM), Tete (NM). ZIMBABWE. Albany Farm, Chimanimani (NMZB), Atlantica (NMZB), Bangala Dam (NMZB), Banti Forest Reserve (NMZB), Bikita (NMZB), Birchenough Bridge (TM), Bridal Veil Falls (NMZB), Bulawayo (NMZB), Bulldog Mine, Mutare (NMZB), Bundi River, Chimanimani Mountains (NMZB), Changadzi River (NMZB), Charama Plateau, Gokwe (NMZB), Chimanimani Mountains (East & West) (NMZB), Chinhoyi Caves Pool (NMZB), Chinyamanda (NMZB), Chinyika Reserve (NMZB), Chiredzi North (NMZB), Chiredzi River (NMZB), Chirinda Forest (NMZB), Chirisa Safari Area (NMZB), Chishawasha (NMZB, SAM), Chivake River Bridge (NMZB), Cleveland Dam (NMZB), Concession

(NMZB), Darwendale (NMZB), Dunblane (NMZB), Engwa (NMZB), Fishan (NMZB), Foliot Farm (NMZB), Gairezi River (NMZB), Glen Clova (NMZB), Gleneagles (NMZB), Glendale (NMZB), Gokwe (DM), 18 km ESE Gorube (NMZB), Gulati C.L. (NMZB), Gwaai River, Darwendale (NMZB), Gwebe River, Darwendale (NMZB), Harare (NMZB, SAM), Haroni River (NMZB), Haroni Valley (NMZB), Hazelside (NMZB), Honde Valley (NMZB), Hope Fountain (NMZB), Hot Springs, Chimanimani (NMZB), Hunyani River, Chinhoi (NMZB), Inyangani Mountain (NMZB), Karoi (NMZB), Kazungula Ranch (NMZB), KweKwe (NMZB), Kyle Dam (NMZB), Leopard Rock (NMZB), Linslade Farm, Lalapanzi (NMZB), Longueville Ranch (NMZB), Lower Mtarazi River, Inyanga (NMZB), Lundi River Bridge (NM), Lutope River, Gokwe (NMZB), Madingazula Dam (NMZB), Maleme Dam (NMZB), Mangwe Pass (NMZB), Mare Dam, Inyanga (NMZB), 2 km N Mare Dam (NMZB), Matopo Mission (NMZB), Matopos (DM), Mazoe (BM), Melfort (NMZB), Moodies Pass (NMZB), Mount Hampden (NMZB), Mount Selinda (TM), Msorodoni (NMZB), Mtarazi Falls, Inyanga (NMZB), Mucheni Gorge (NMZB), Mucrera River, Chimanimani Mountains (NMZB), 6 km ESE Mupudzi Bridge, Mutare (NMZB), Murewa (NMZB), Muriel Mine (NMZB), Musirizwi River (NMZB), Mutare (NM, NMZB), 6 km N of Mutoko (NMZB), Mutorashanga Pass (NMZB), Mvurwi (NMZB), Ngorima C.L. (East) (NMZB), Nyadakese Dam (NMZB), Nyahodi Bridge, Chimanimani (NMZB), Nyamakari (NMZB), Nyamashato River (NMZB), Nyanyadzi (NMZB), Nyazura (NMZB), Odzani Dam (NMZB), Odzi (NMZB), Pachanza (NMZB), Penhalonga (MM), Plumtree (NMZB), Retreat Farm (NMZB), Rhodes Estate Office, Inyanga (NMZB), Ruenya River Drift, Mutoko (NMZB), Rugare (NMZB), Rukute Farm (NM, NMZB), Runde C.L. (NMZB), Ruwa River Bridge (NMZB), Selborne (NMZB), Selous (NMZB), Sengwa Gorge, Gokwe (NMZB), Sengwa River, Gokwe (DM, NMZB), Shurugwi (NMZB), Silverstreams (NMZB), Siyanje (NMZB), Somabhula (NMZB), Sote Source, Gutu (NMZB), Spitzkop (NMZB), Stapleford (NMZB), The Corner (NMZB), Thorn Park, Harare (NMZB), Togwe Wild Area (NMZB), Troutbeck (NMZB), Tsetsera (NMZB), Tshabezi Bridge (NMZB), Tynwald, Harare (NMZB), Van Niekerk's Ruins (NMZB), Vumba Mountains (NMZB), Weltevreden Farm (NMZB), Whitewaters, Mutare (NMZB), Wicklow (NMZB), Zewa (NMZB), Zimbabwe Ruins (NMZB).

*Rana johnstoni johnstoni* Günther

*Rana johnstoni* Günther 1893: 620. 'Tshiromo', ie. Chiromo, Malaŵi (but see under Distribution). Types in the British Museum, London. Loveridge 1953a: 367, Poynton 1964b: 203, Stewart 1967: 57, Stevens 1974: 6.

**Diagnosis.** Head width/tibia length 0,66–0,76; head width/foot length more than 0,60; tympanum/eye 0,50 or less.

**Description.** Females up to 64 mm. Head obtusely pointed, relatively small tympanum, heavily webbed feet (1 to 2 phalanges of 4th toe free). Legs relatively short. Greenish in life with a black, broad interorbital V or triangle, and other irregular dorsal spots or blotches, variable in size and in some individuals so expanded as virtually to produce uniform dark coloration. Ventral surface of adult

males with a light gular marbling to widespread, heavy marbling; females heavily marbled ventrally.

*Habitat.* Restricted to the cold mountain streams on Mulanje Mountain. Strongly aquatic: adults frequent deep pools and hide beneath submerged boulders when disturbed. Juveniles are found in shallow rock pools.

*Distribution.* Although the type locality is in the lower Shiré basin, there are several reasons for doubting the correctness of the record (Poynton 1964b). This form is related to other highland forms, and subsequent collecting has consistently shown it to occur only on the highlands, above 2 000 m, of Mulanje Mountain, Malawi.

*Localities.* MALAWI. Ruwaba Basin, Madzeka Basin, Sombani Basin of Mulanje Mountain (NMZB). Chambe Plateau, Mulanje Mountain (Stewart 1967). Plateaux of Mulanje Mountain (Stevens 1974).

### *Rana johnstoni inyangae* Poynton

*Rana johnstoni inyangae* Poynton 1966: 1. Inyangani Mountain, Inyanga dist., Zimbabwe. Holotype in the National Museum, Bulawayo. Channing 1976: 1, Lambiris 1985a: 203.

*Diagnosis.* Head width/tibia length 0,58–0,67; head width/foot length more than 0,55; tympanum/eye less than 0,50.

*Description.* Largest known specimen a 59 mm male, females probably larger. Head fairly acutely pointed, relatively small tympanum, heavily webbed feet (1 to 2 phalanges of 4th toe free). Legs relatively short. Green to brown ground colour, with a dark interorbital V or triangle, and other irregular dorsal spots and blotches. Gular and pectoral region marbled.

*Habitat.* Mountain streams. Adults found sitting on rock ledges behind waterfalls, or on rocks in the middle of rapids. Juveniles found in more quiet backwaters.

*Remarks.* The description of the holotype contains an error: for 'Head width/tibia length = 1,01' read 'Head width/skull length = 1,01'. The reason for using the subspecific category in this species is stated in the discussion of *Strongylopus* (p. 136).

*Distribution.* Adults known only from Inyangani Mountain, Zimbabwe, above 2 000 m. Tadpoles known from Chimanimani National Park.

*Localities.* ZIMBABWE. Inyangani Mountain (NMZB), The Corner, Chimanimani National Park (NMZB).

### Genus *Strongylopus* Tschudi

*Strongylopus* Tschudi 1838: 38. Type species yet to be designated (Dubois 1981). Channing 1981: 333, Clarke 1981: 320, Dubois 1981: 230.

Stream frogs (Passmore & Carruthers 1979: a name not wholly applicable). Vomerine teeth present, lying between the choanae. Omosternum moderately forked, clavicles straight, transverse, approaching each other medially. Feet long, length at least equal to distance from tip of urostyle to tympanum. Toes moderately to weakly webbed. Outer metatarsal separated from rest of sole by a web, inner

metatarsal tubercle compact and small. A single, weakly developed gular pouch in males.

See discussion of the family Ranidae regarding the status of this group. Distribution centred on the eastern highlands of South Africa, with disjunct distribution northwards along highlands to northern Tanzania. Eggs laid in water or among waterside plants.

As noted in the discussion of the family Ranidae, this genus seems cold-tolerant, perhaps even more so than *Rana*, with a centre of diversity in the eastern highlands of South Africa. The genus seems to exemplify the Hennig–Brundin ‘progression rule’ (eg. Brundin 1981), where relatively primitive taxa occur in the presumed initial range of the group (in this case the South African eastern highlands), while more advanced taxa occur at the periphery. What appear to be the most derived species, *grayii* and *fasciatus* (Channing 1981), are the only two with populations north of the Limpopo. The *grayii* population in eastern Zimbabwe has undergone some differentiation, and is customarily given subspecific status (*rhodesianus*). The *fasciatus* population has not undergone noticeable differentiation in Zimbabwe, but has recognisably different populations in the highlands of Malawi and southern Tanzania (*fuellleborni*) and northern Tanzania (*merumontanus*) (Poynton 1964b). Lack of divergence in the Zimbabwean population of *fasciatus*, in contrast to the *grayii* population, is not surprising: *fasciatus* is a much more wide-ranging animal than *grayii*, as the sections on habitat under the various forms indicate, with the result that *fasciatus* is likely to have been separated from the South African centre by the Limpopo Basin for less time than has *grayii*. The wide-ranging tendency of *fasciatus* evidently also accounts for its presence as sole representative of the genus north of the Zambezi.

The reason for using the subspecific category in the cases of *grayii* and *fasciatus* is stated in the Introduction to Part 1 of this study (Poynton & Broadley 1985). There it is pointed out that when disjunct taxa are evidently the relicts of wider distributions achieved during a different climatic phase, then the use of the subspecific category serves the purpose of emphasising the phylogenetic and biogeographical affinities of the current taxa. The same reasoning is applied in the similar case of *Rana johnstoni* (p. 135).

#### *Strongylopus grayii rhodesianus* (Hewitt)

*Rana grayi rhodesiana* Hewitt 1937: 12, pl. 1. Chirinda Forest. Holotype in the National Museum, Bulawayo. FitzSimons 1939: 41, Poynton 1964a: 114.

*Rana grayii grayii*; FitzSimons (not Smith) 1958: 213.

*Strongylopus grayii rhodesianus* (Hewitt), Channing 1981: 334, Lambiris 1985b: 251.

**Diagnosis.** Head width/tibia length 0,50–0,58; head width/foot length 0,46–0,50; tympanum/eye 0,50 or usually more.

**Description.** Not normally exceeding 45 mm. Head fairly acutely pointed, moderate to relatively large tympanum (see Diagnosis), very reduced webbing (4, rarely 3, phalanges of 4th toe free). Legs and feet relatively long, foot extending distance from tip of urostyle to tympanum or eye.

Extremely variable in dorsal markings from immaculate to more or less spotted (with or without a light dorsal band) to striped (see Remarks).

*Habitat.* Ranging from evergreen forest to open grassland, and found in bracken at Inyanga and on Gorongosa Mountain. See Remarks regarding colour phases related to habitat.

*Remarks.* It seems very likely that the more slender body and elongated fourth toe of *g. rhodesianus*, noted by Hewitt when he compared it with *g. grayii*, is due to genetic mixing with *fasciatus*. Some specimens from both the northern and southern regions of the eastern Zimbabwean highlands present difficulties in identification: the markings consist of a typical *fasciatus* light vertebral band bordered by a pair of paravertebral stripes commencing on the median edges of the eyelids. But the lateral markings consist of spotting and marbling, not stripes as in *fasciatus*, and the tibia shows cross banding, which is also a feature of *grayii* rather than *fasciatus*. Even in specimens with a more typical *grayii* patterning, however, there is usually a distinct dark line running down the lateral margin of the tibia, which is characteristic of *fasciatus*, and not or only indistinctly shown in *g. grayii*. This tibial line is also prominently shown in specimens of *rhodesianus* without dorsal markings. The call of *rhodesianus* is more like *fasciatus* than *g. grayii*, both in its higher pitch and tendency to run into a trill.

The range in markings appears to group into two colour phases, which are associated with habitat. The 'typical' phase, a uniform yellow, brown or russet dorsum, is found in evergreen forest, where it is well camouflaged among leaf litter. The spotted phase, yellow with small brown spots, occurs in open grassland, especially in the Chimanimani Mountains (where the 'typical' phase is parapatric in adjacent forest patches).

*Distribution.* Eastern Zimbabwean escarpment and Gorongosa Mountain in Mozambique.

*Localities.* MOZAMBIQUE. Gorongosa Mountain (NMZB), Martins Falls (NMZB). ZIMBABWE. Banti Forest Reserve (NMZB), Chimanimani (NMZB), Chimanimani Mountains (East) (NMZB), Chimanimani Mountains (West) (NMZB), Chirinda Forest (NMZB), Cloudlands (NMZB), Dunblane (NMZB), Engwa (NMZB), Gleneagles (NMZB), Haroni River (NMZB), Haroni Valley (NMZB), Inyangani Mountain (NMZB), 2 km N Mare Dam (NMZB), Mount Chililokwe (NMZB), Mount Selinda (NMZB, TM), Ngorima C.L. (East) (NMZB), Penhalonga (NMZB, TM), Rhodes Estate Orchards, Inyanga (NMZB), Selborne (NMZB), Silverstreams (NMZB), Stapleford (NMZB), Tandaai (NMZB), Tsetsera (NMZB), Upper Pungwe River (TM), Vumba Mountain (NMZB), Weltevreden Farm (NMZB).

### *Strongylopus fasciatus fasciatus* (Smith)

*Rana fasciata* Smith 1849: 78, fig. 1a, b, c, Southern Africa. Neotype in the British Museum (N.H.), London (vide Opinion 713, *Bull. zool. Nomencl.* 21: 352–354). Poynton 1964a: 115.

*Rana fasciata* (Tschudi), FitzSimons 1939: 40.

*Strongylopus fasciatus fasciatus* (Smith), Channing 1981: 334.

*Diagnosis.* Head width/tibia length not more than 0,52; head width/foot length not more than 0,43; tympanum/eye more than 0,50.

*Description.* Length not exceeding 50 mm. Head acutely pointed, relatively large tympanum (see Diagnosis), very reduced webbing ( $3\frac{1}{2}$  to 4 phalanges of 4th toe

free). Legs and feet very long, foot extending distance from tip of urostyle to tympanum or eye.

A broad buff to orange band from tip of snout to tip of urostyle, heavily bordered by a pair of dark, usually continuous, paravertebral bands, underlain by skin ridges. Laterally, usually three pairs of more oblique dark bands, often broken or reduced to spots. Tibial markings elongated, no cross banding.

*Habitat.* This 'grass frog' is found in open grasslands of the eastern highlands and along the main watershed in Zimbabwe. It calls along stream banks or grassy vleis usually under cover of vegetation, but it is often encountered at a considerable distance from water.

*Distribution.* Uplands of Zimbabwe. Disjunct from South African populations on the Transvaal plateau, eastern plateau slopes, south-eastern and southern Cape seaboard (see Remarks under *Strongylopus*).

*Localities.* ZIMBABWE. Banti Forest Reserve (NMZB), Chido (NMZB), Chimanimani Mountains (East) (NMZB), Chimanimani Mountains (West) (NMZB), Ditchwe (CRP), Engwa (NMZB), Harare (CRP), Inyanga Downs (CRP), Marondera (NMZB), Mare Dam (NMZB), Matopo Hills (NMZB), Matopo Mission (NMZB), Mount Selinda (TM), Musirizwi River (NMZB), Mutare (NMZB), Nyazengu (NMZB), Odzani Dam (NMZB), Old Umtali (NMZB), Rhodes Estates Office, Inyanga (NMZB), Selborne (NMZB), Shinda (NMZB), Shurugwe (NMZB), Silverstreams (NMZB), Stapleford (NMZB), The Corner (NMZB), Togwe Wild Area (NMZB), Troutbeck (NMZB), Tsetsera (NMZB), Warren Hills (NMZB).

### *Strongylopus fasciatus fuelleborni* (Nieden)

*Rana fülleborni* Nieden 1910: 436. Ngosi Crater Lake, Poroto Mountains, Tanzania. Holotype in the Zoologisches Museum, Berlin.

*Rana fasciata fülleborni* Nieden, Loveridge 1953a: 373.

*Rana fasciata fülleborni* Nieden, Poynton 1964b: 203, Stewart & Wilson 1966: 299, Stewart 1967: 58, Broadley 1971: 113, Stevens 1974: 6.

*Strongylopus fasciatus fülleborni* (Nieden), Channing 1981: 334.

*Diagnosis.* Head width/tibia length more than 0,52; head width/foot length 0,42–0,50; tympanum/eye more than 0,50.

*Description.* Length not exceeding 53 mm. Head acutely pointed, relatively large tympanum (see Diagnosis), very reduced webbing (4 phalanges of 4th toe free). Legs and feet long, foot extending distance from tip of urostyle to just behind to just in front of tympanum.

A broad buff to orange band from tip of snout to tip of urostyle, heavily bordered by a pair of usually continuous dark paravertebral bands, underlain by skin ridges. A pair of faint dark vertebral lines usually present in light band. Laterally, usually three pairs of more oblique dark bands, often broken.

*Habitat.* Same as the nominate subspecies. Stewart & Wilson (1966) describe the Nyika Plateau population as 'widespread over the grasslands far from water except when breeding'. Adults are reported to call 'from underneath overhanging vegetation around wet areas'. Channing (1981) reports the call to be identical to that of the nominate subspecies.



*Distribution.* Mountains of Malaŵi, eastern Zambia and southern Tanzania.

*Localities.* ZAMBIA. Nyika Plateau (AMNH, NMZB). MALAŴI. Chelinda Bridge, Nyika Plateau (BM, AMNH, NMZB), Mount Mulanje (Tuchila Plateau) (BM), Shiré Highlands (BM), Zomba Mountain (NMB). Nyika Plateau; Zomba Plateau; Mount Mulanje ( Loveridge 1953a), Nyika Plateau (Stewart 1967), Zomba and Mulanje Mountains (Stevens 1974).

### Genus *Hylarana* Tschudi

*Hylarana* Tschudi 1838: 83. Type by monotypy: *Hyla erythraea* Schlegel. Clarke 1981: 319, Dubois 1981: 241.

White-lipped or Golden-backed Frogs. Vomerine teeth present, lying between choanae. Omosternum moderately forked, clavicles straight, transverse, approaching each other medially. Toes webbed. Outer metatarsal separated from rest of sole by web, inner metatarsal tubercle compact and small. Digital discs present in some species. A broad, golden to brown, often speckled band passing over head and back to tip of urostyle, sometimes with lighter edging and in more northern species bordered by a glandular ridge. Upper jaw tending to be lightly coloured or whitish, especially conspicuous in some species.

Males with a single, weakly developed gular pouch, or, in some species, with a pair of baggy pouches opening to exterior by slits. Breeding males with an extensive, flat gland on antero-ventral region of humerus.

Africa south of the Sahara to Indonesia. Various species occupy a variety of habitats from forest to grassland to swamp. Eggs laid in water in the species so far studied.

Perret (1977) has reviewed the species of *Hylarana* occurring in Cameroun, and his list of African species is followed here.

### *Hylarana darlingi* (Boulenger)

*Rana darlingi* Boulenger 1902: 15, pl. 3, fig. 1. Mazoe and between Umtali (Mutare) & Marandellas (Marondera), Zimbabwe. Syntypes in the British Museum (N.H.), London. Broadley 1971: 113, Stevens 1974: 7.

*Hylarana darlingi* (Boulenger), Poynton 1964a: 119, Perret 1977: 843.

*Diagnosis.* Distance from nostril to eye greater than interorbital distance. Tips of fingers and toes not expanded into discs. Two to 3 phalanges of fourth toe free of main webbing. Gular pouch barely developed.

*Description.* Males not normally exceeding 55 mm, females not exceeding 63 mm. A broad golden to light brown band running over snout and backwards over head and upper eyelids to above vent. Band immaculate or speckled, edges usually lighter. No conspicuous skin ridge at edge of band. Flanks a fairly uniform darker brown to olive. A white line running from above axilla below tympanum and eye to narial region, but remainder of upper lip usually mottled to marbled. Juveniles spotted ventrally, but adults tending to become virtually immaculate below, apart from light spotting on legs.

*Habitat.* Inhabits open savannas, but also occurs in lowland evergreen forest at the Lusitu lagoon.

*Distribution.* Mainly upland areas of Mozambique, southern Malaŵi, Zimbabwe, Zambia, southern Zaïre, Angola.

*Localities.* ZAMBIA. 16 km W Chisamba (AJL), Kalabo (FMNH), Livingstone (BM), Lutakila R., Mpika (FMNH), Monze (NMZL). MALAWI. Mulanje dist. (Stevens 1974). MOZAMBIQUE. 13 km SSE Vila Gouveia (NMZB). ZIMBABWE. Atlantica R.S. (AJL), Borrowdale (NMZB), Bromley (NMZB), Chinyika Reserve (NMZB), Christon Bank (NMZB), Cleveland Dam (NMZB), Corfe Farm (AJL), Darwendale (NMZB), Fairfield (NMZB), Foliot Farm (NMZB), Harare (NMZB), Haroni/Rusitu Confluence (NMZB), Honey River Bridge (NMZB), Imire Farm (NMZB), Kutama Mission (AJL), Lake MacIlwaine (NM, NMZB), Marondera (NMZB), Mazoe (BM), Mount Hampden (NMZB), Mount Selinda (NMZB), Murewa (NMZB), Ngezi Dam (AJL), Ngorima Reserve (East) (NMZB), Nyamunyeche Farm (NMZB), Nyazura (NMZB), Old Umtali (BM, NMZB), Retreat Farm (NMZB), Selous (NM), Shavanhohwe River, Murewa (NMZB), Sote Source (NMZB), Thorn Park (NMZB), Umfesi (NMZB), Watsomba (NMZB), Windrush Farm, Marondera (NMZB).

### *Hylarana lemairei* (Witte)

*Rana lemairei* Witte 1921: 1, pl. 1, fig. 1,2,3,4. Lofoi, Shaba, Zaïre. Holotype in the Koninklijk Museum voor Midden Afrika, Tervuren.

*Rana albolabris lemairei* Witte, Broadley 1971: 114.

*Hylarana lemairei* (Witte), Perret 1977: 844.

*Diagnosis.* Distance from nostril to eye subequal to interorbital distance. Tips of fingers and toes expanded into distinct discs with circummarginal grooves. Two to 2½ phalanges of fourth toe free of main webbing, but margin of web extending to disc. Gular pouch barely developed.

*Description.* Males reaching 66 mm in Shaba (Schmidt & Inger 1959) and females 76 mm, with means of 53 mm and 64 mm respectively. A brownish dorsal band, with or without darker speckling, and demarcated by a pair of prominent skin ridges running from eyes to leg insertion. Flanks a more uniform, darker brown to slate. Usually a prominent white line running from above axilla below tympanum and eye to narial region, spreading out in a general whitening of the upper lip. Webbing well developed, a substantial margin reaching discs of all toes.

Schmidt & Inger (1959) report that juveniles are not spotted ventrally. A PEM juvenile from Mporokoso is immaculate ventrally, but not a newly metamorphosed MM specimen from Nkana, which has ventral spotting.

*Habitat.* The Ikelenge specimen was collected in riparian forest.

*Distribution.* Southern Zaïre, western Zambia, north-eastern Angola.

*Localities.* ZAMBIA. Ikelenge (NMZB), Isombu (NMZB), Mporokoso (PEM), Nkana Mine (MM), Nkana (NMZB), Sakeji (NMZB), Salujinga (AMNH).

### *Hylarana galamensis* (Duméril & Bibron)

*Rana galamensis* Duméril & Bibron 1841: 367. Lake Galam, Senegal. Holotype in the Muséum National d'Histoire Naturelle, Paris. Boulenger 1907a: 481, Parker 1930: 897.

*Limnodytes bravanus* Peters 1882: 9. Brava, Somalia. Type apparently lost.

*Rana galamensis bravana* (Peters), Loveridge 1953a: 364, Stevens 1974: 7.

*Hylarana galamensis bravana* (Peters), Poynton 1964a: 121 & 1964b: 204, Stewart 1967: 62.

*Hylarana galamensis* (Duméril & Bibron), Perret 1977: 845.

*Diagnosis.* Distance from nostril to eye equal to interorbital distance. Tips of fingers and toes not expanded into discs. Two and a half to slightly more than 3 phalanges of fourth toe free of web. Males with a pair of baggy, darkly pigmented gular pouches, opening through a pair of slits parallel to the mandible.

*Description.* Males reaching 78 mm, females 86 mm. A broad dorsal golden to brown band, almost immaculate to heavily speckled but usually leaving a lighter margin, which overlies a pair of flattened ridges running from eyes to leg insertions. Flanks light-spotted to marbled. Upper lip with lighter coloration. Abdomen speckled, but less markedly in large individuals.

*Habitat.* A strongly aquatic species, restricted to permanent lakes and swamps. At Beira, a series was collected from water-filled holes excavated for lamp standards in the Estoril swamp. At the edge of Lake Chilwa, two specimens were found sheltering beneath a derelict dugout canoe at the end of the dry season.

*Distribution.* Mozambique, Malawi lowlands, northern Zambia northwards over savannas to southern Somalia and westwards to Senegal.

*Localities.* ZAMBIA. Chilubi Island, Lake Bangweulu (NMZL), Mpulungu (PEM), Niamkolo (BM). MALAWI. Likabula River (AMNH), Limphasa Dambo (NMZB), Mchenga (NMZB). MOZAMBIQUE. Beira (BM, NM, NMZB), Fambani River (BM), Zinave (NMZB).

#### Genus *Hildebrandtia* Nieden

*Hildebrandtia* Nieden 1907: 229. Type by designation of Boulenger 1919: *Pyxicephalus ornatus* Peters. Clarke 1981: 321, Dubois 1981: 241.

Ornate Burrowing Frog. Vomerine teeth present, touching anterior corners of the choanae. Omosternum moderately forked, clavicles curved, lying close to anterior margin of coracoids and widely separated from each other. Toes webbed. Outer metatarsals bound into a fleshy sole, inner metatarsal tubercle well developed and flange-like.

Males with sac-like gular pouches, everted through slits set obliquely to mandible.

Savanna areas of Africa, excluding nearly all of Namibia, Botswana, Transvaal apart from eastern lowlands. Apparently not reaching Natal. Eggs laid in water.

#### *Hildebrandtia ornata ornata* (Peters)

*Pyxicephalus ornatus* Peters 1878: 207. Taita (ie. Teita), Kenya. Type in the Zoologisches Museum, Berlin.

*Rana ruddi* Boulenger 1907a: 480, pl. 22, fig. 1. Beira, Mozambique. Type in the British Museum (NH), London. Hewitt & Power 1913: 168, Boulenger 1919: 34.

*Rana ornata* (Peters), Boulenger 1919: 34.

*Hildebrandtia ornata ornata* (Peters), Poynton 1964a: 122 & 1964b: 205, Stewart 1967: 64, Broadley 1971: 114, Stevens 1974: 7.

*Diagnosis.* Differing from *o. moeruensis* Boulenger 1901, known from Pweto and Upemba Park, in the distinct dark and light banding of the gular region (in *moeruensis*, gular region more generally darkened, obscuring light bands) and the larger metatarsal tubercle (tubercle longer than first toe in *ornata*, subequal to length of first toe in *moeruensis*). Schmidt & Inger (1959) also indicate a larval

difference, *ornata* (from Somalia) having one upper labial tooth row, which is lacking in *Upemba moeruensis*. But South African material referred to *ornata* also lacks this row (van Dijk 1966).

*Description.* Females not known to exceed 70 mm, males, 65 mm. Webbing just reaching middle subarticular tubercle of fourth toe to falling half way between middle and proximal tubercle. A broad golden-brown and/or green band running over top of head, and continuing over back to above vent. Contained in this band is a paired paravertebral series of dark spots, rounded or elongated, or a single pair of continuous paravertebral bands which may fuse with a patch on the upper eyelid and/or fuse with the opposite paravertebral band. The continuous bands are more typical of specimens in the eastern part of the range, and fragmentation to sparse spotting more typical of western material, but specimens close to the two extremes are well illustrated from the Kruger National Park, South Africa, by Passmore & Carruthers (1979: 148). Gular region with a pair of light bands commencing near tip of jaw and diverging towards pectoral region, usually with a secondary branch commencing further back along jaw, forming a Y-shaped figure.

*Habitat.* This burrowing frog inhabits open savanna and breeds in shallow pools and pans. Its bellowing call can be heard from a considerable distance.

*Remarks.* Any *Hildebrandtia* collected from northern Zambia is likely to be *o. moeruensis*, type locality Pweto and known from the Upemba Park. Such material should be checked against the diagnosis given above.

*Distribution.* Northern Namibia and southern Angola, at least southern and eastern Zambia, Zimbabwe, Mozambique, eastern Transvaal north to Kenya.

*Localities.* ZAMBIA. Kabwe (BM), Livingstone (NMZL), Monze (NMZL). MOZAMBIQUE. Amatongas (NMZB), Beira (BM, NMZB), Inchope (NMZB), 25 km N Lower Revue Bridge (NMZB), Magasso (NMZB), 8 km E Mapulanguene (TM), Metuchira (NMZB), Muda River Bridge (NMZB), 19 km SW Mungari (NMZB), Savane (NMZB), Xiluvo (NMZB), Zinave (NMZB). ZIMBABWE. Antelope (NM), Buffalo Bend Pan (NMZB), Charara Confluence, Kariba (NMZB), Chipinda Pools (NMZB), Eldorado (MM), Gokwe/Sanyati C.H.A. (NMZB), 16 km W Harare (NMZB), Kamashoboya/Lutope Confluence (NMZB), KweKwe (NMZB), Linkwasha, Hwange National Park (NMZB), Lundi River Bridge (NM), Machinawa Pans (NMZB), Majinji Pan (NMZB), Malugwe Pan (NMZB), Msoro (NMZB), 51 km NE Mutoko (NMZB), Musami (AM), Ngamo Forest Area (NMZB), Nyala Pan (NMZB), Nyamandhlovu Pan (NMZB), Nyakasikana (NMZB), Sengwa River (NMZB), Shoka Farm (NMZB), 10 Mile Drive, Hwange N.P. (NMZB).

### Genus *Ptychadena* Boulenger

*Ptychadena* Boulenger 1917: 988. Type by designation of Boulenger 1918a: *Rana mascareniensis* Duméril & Bibron 1841. Dubois 1981: 248, Clarke 1981: 320.

*Abrana*; Parker 1930 (not Strand 1928: 59, Mammalia): 898. Type by monotypy: *Abrana cotti* Parker. *Parkerana* Dubois 1984: 39. Replacement name for *Abrana* Parker.

Ridged frogs. Vomerine teeth present, touching anterior corners of the choanae. Omosternum broadly forked, clavicles usually ossified but a mere ligament in *cotti*,

curved, lying close to the anterior margin of the coracoids and widely separated from each other. Toes webbed. Outer metatarsal separated from the rest by webbing, inner metatarsal tubercle compact and small, outer metatarsal tubercle absent to (rarely) well-developed. Males with lateral, external vocal sacs.

Africa, centered in the tropics although many species are limited to the higher altitudes. Also east oceanic islands. Adults usually not ranging far from water. Basically a savanna genus in the southern third of Africa, although there are several sylvicolous species north of the area.

*Ptychadena* is by far the largest ranid genus in the Zambesiaca area, but it is composed of species very similar in appearance and hence easily confused. It is likely that there are species known from Angola and Zaïre which occur unrecorded in Zambia. In particular *P. frontalis* Laurent of southeastern Zaïre should be looked for in northern Zambia. Reference should be made to Schmidt & Inger (1959), Laurent (1964) and Poynton (1970) in cases of uncertainty, and also to the key in Stevens (1972).

Stewart (1967) recorded differing escape behaviour in different species when flushed: a species either tends to leap into water, or away from water to take cover in vegetation. We have confirmed this tendency in a few of the species. It seems worth examining the tendency in all species, as it could prove a serviceable 'character' in subgeneric classification, as well as being of ecological interest. Species recorded as having a tendency to leap into water are *subpunctata* and *mascareniensis*. Those recorded as tending to escape away from water are *oxyrhynchus*, *anchietae*, *porosissima*, *uzungwensis*, *guibei* and *mossambica*.

#### *Ptychadena subpunctata* (Bocage)

*Rana subpunctata* Bocage 1866: 73. Duque de Bragança, Angola. Type missing (Perret 1976), presumed destroyed.

*Rana chobiensis* FitzSimons 1932: 39. Kasane on the Chobe River, Botswana. Holotype in the Transvaal Museum, Pretoria. FitzSimons 1935: 385.

*Ptychadena subpunctata* (Bocage), Poynton 1964a: 127 & 1970: 368, Broadley 1971: 115.

**Diagnosis.** Distance from nostril to snout tip greater than interorbital distance, equal to, to less than distance from nostril to eye. Gular pouch slits ending level with lower edge of arm insertion, to the middle of arm insertion. No outer metatarsal tubercle, no row of tubercles under fourth metatarsal.  $1\frac{1}{2}$  to 2 phalanges of fourth toe free of web, less than one phalanx of fifth free. Length of foot subequal to, to greater than, length of tibia. Top of snout lighter, either forming a clearly defined triangular patch or receiving a continuation of a light vertebral band. Light longitudinal line usually present on upper surface of tibia and less often on thigh. Posterior face of thigh with strongly contrasting light and dark longitudinal stripes, and at least two dark bands running from knee to knee below vent. Lower jaw heavily marbled. Ventral surface speckled with brown, rarely immaculate.

**Habitat.** Swamps and river backwaters, common along the upper Zambezi and the rivers of the Okavango system.

**Distribution.** Northern Namibia, Angola, Botswana, northwestern Zimbabwe, Zambia, southeastern Zaïre.

**Localities.** BOTSWANA. Four Rivers Camp (NMZB), Gomoti River (NMZB),

Gumare (NMZB), 24 km NE Gumare (NMZB), Kabolebole (BM, TM), Kasane (TM), Khumaga (NMZB), Maun (TM), Maxwee (NMZB), Mpalela Island (TM), Pom Pom (NMZB), Savuti River (NM, NMZB), Moremi Reserve, 15 km from SE gate (TM), Sepopa (NMZB, TM), Shakawe (NMZB, TM), Xugana (TM), Xaxaba (NMZB). CAPRIVI. Kwando River, Western Caprivi (TM), Lake Liambezi (TM), Old Sangwali (TM), Popa Rapids (TM). ZAMBIA. Chavuma (NMZB), Ikelenge (NMZB), Kalenga (NMZB), Kalabo (AMNH, FMNH, NMZB), Livingstone (NMZL), Mayau River (AMNH), Senanga district (FMNH), Sesheke (NMZL). ZIMBABWE. Katombora (NMZB), Kazungula (NMZB), Namakurwe River (NMZB), Victoria Falls (NMZB).

*Ptychadena oxyrhynchus* (Smith)

*Rana oxyrhynchus* Smith 1849: pl. 77. 'Kaffirland and the region of Port Natal'. Lectotype (Guibé & Lamotte 1960: 382) in the British Museum, London. Peters 1882: 147, Boulenger 1897: 801 & 1907: 481, Parker 1930 (part): 898.

*Rana oxyrhynchus gribinguiensis* Angel, Loveridge 1953a: 368.

*Ptychadena oxyrhynchus* (Smith), Guibé & Lamotte 1960: 380, Poynton 1964a: 124 & 1964b: 206 & 1966: 18 & 1970: 368, Stewart 1967: 66, Broadley 1971: 114, Stevens 1974: 7.

**Diagnosis.** Distance from nostril to snout tip greater than internarial distance, equal to, to greater than, distance from nostril to eye (tip very liable to become compressed in preserved material). Gular pouch slits ending level with lower edge of arm insertion. No outer metatarsal tubercle, no row of tubercles under fourth metatarsal.  $1\frac{1}{2}$  to 2 phalanges of fourth toe free of web, less than one phalanx of fifth toe free. Length of foot less than length of tibia. Top of snout lighter, forming a clearly defined triangular patch. No light vertebral band, no light line on upper surface of tibia. Posterior face of thigh mottled, light markings not tending to form parallel, continuous longitudinal bands. Jaw heavily marbled along entire length to continuously darkened.

**Habitat.** Moist savanna to lightly wooded areas, entering forest to a limited extent. Not ranging far from water, the species breeds in shallow pools along streams or dambos, also in pools on rock outcrops.

**Distribution.** Savanna and woodland areas of subsaharan Africa from Senegal to the eastern Cape Province of South Africa.

**Localities.** BOTSWANA. Four Rivers Camp (NMZB), Khwai River (NMZB), Xaxaba (NMZB). CAPRIVI. Katima Mulilo (NMZB). ZAMBIA. Chilanga (FMNH, NMZB), Isoka (BM), Kabwe (BM), Kalungu (BM), Kasama (NMZL), Lake Chila (BM, FMNH), Mkanda area (NMZB), Mukulaikwa (NMZB), Mungwi (BM), Mweru Wantipa (BM), Ndola (NMZB), Ngambwe Falls (NMZB), Niamkolo (BM), Sala Reserve (NMZB), Sayiri Court (NMZB), Sesheke (NMZB). MALAWI. Lifupa (NMZB), Limphasa Dambo (NMZB), Lujeri (NMZB), Misuku Hills (East) (NMZB), Mulanje (NMZB), Nkhata Bay (NMZB), Nyika Plateau (BM), Rumpi (NMZB), Zomba (BM), Cholo Mountain; Misuku Mountains; Nchenachena; Nchisi Mountain (Loveridge 1953a). MOZAMBIQUE. Amatongas (NM, NMZB), Beira (Macuti) (NMZB), Bela Vista (DM), Boror (NMZB), Chapala (NMZB), Chemba (NMZB), Chimonso (TM), Chiniziua District (NMZB), Comacha (NMZB), Dondo (NMZB), 16 km NNW Dondo

(NMZB), 10 km NE Dondo (NMZB), Estatuane (NMZB), 6 km S Estatuane (NMZB), Garuso (NMZB), Gorongoza Mountain (NMZB), Inhaca Island (NMZB), 10 km W Inhassoro (NMZB), 8 km E Jangamo (NMZB), Machipanda (NM), Mavita (NMZB), Mitucué Mountain (NMZB), 15 km S Mwanza (NMZB), Nampula (NMZB), Nova Sofala (NMZB), 15 km SE Vila Franca do Save (NMZB), 10 km SSE Vila Gouveia (NMZB), Vila de Manica (NMZB), 15 km SE Vila de Manica (NMZB). ZIMBABWE. Atlantica (AJL, NMZB), Audley End Farm (AJL), Bangala Dam (NMZB), Bembezi (NMZB), Bikita (NMZB), 8 km SE Chakari (AJL), Chegutu (NMZB), 8 km E Chegutu (AJL), Chetora 'B' (NMZB), Chinhoyi (NMZB), Chinyamanda (NMZB), Chivake River Bridge (NMZB), Concession (NMZB), Darwendale (AJL), Fatima (NMZB), Gokwe (NM, TM), 19 km ESE Guruve (NMZB), Harare (MM, NMZB), 6 km W Harare (NMZB), Haroni/Rusitu Confluence (NMZB), Helvetia Farm (NMZB), Hot Springs (NMZB), Irisvale (NMZB), Kyle Dam (NMZB), Lake MacIlwaine (NMZB), Linslade Farm (NMZB), Lundi River Bridge (NM), Mapoff (NMZB), Marondera (MM), Matusadona NP (AJL), Melfort (NMZB), Mhangura Mine (NMZB), Miware Grove (NMZB), Mount Hampden (NMZB), Murewa (NMZB), Musirizwi (NMZB), Mutare (NMZB), 6 km W Mutoko (NMZB), Ngorima C.L. (East) (NMZB), Nyadekese Dam (NMZB), Nyamashato River Bridge (NMZB), Old Umtali (NMZB), Penhalonga (NMZB), Rukute Farm (NMZB), Saffron Walden (AJL), Sengwa/Kove Confluence (NMZB), Stapleford (NMZB), Tynwald (NMZB), Van Niekerk's Ruins (NMZB), Warren Hills (AJL), West Sebungwe (NMZB), Zimbabwe Ruins (NMZB).

*Ptychadena anchietae* (Bocage)

*Rana anchietae* Bocage 1867: 843. Benguella, Angola. Syntypes destroyed in the Museu Bocage, Lisbon.

*Rana abyssinica* Peters 1881: 163. Ailet, nr. Massawa & Keren, Bogos, Eritrea. Syntypes in the Zoologisches Museum, Berlin.

*Rana oxyrhynchus*; (not Smith) Boulenger 1897: 801, Johnston 1898: 361, Power 1927: 411, Parker 1930 (part) 898, FitzSimons 1935b: 369 & 1939: 40.

*Rana oxyrhynchus oxyrhynchus*; (not Smith) Loveridge 1953a: 369 & 1953b: 147.

*Ptychadena abyssinica* (Peters), Guibé & Lamotte 1961: 384.

*Ptychadena anchietae* (Bocage), Poynton 1964a: 126 & 1964b: 206 & 1966: 18, Stewart 1967: 68.

*Ptychadena superciliaris*; (not Günther) Poynton 1970: 369, Broadley 1971: 114, Stevens 1974: 7.

**Diagnosis.** Distance from nostril to snout tip subequal to internarial distance, equal to, to less than, distance from nostril to eye. Gular pouch slits ending level with lower edge of arm insertion. Outer metatarsal tubercle sometimes feebly developed, no row of tubercles under fourth metatarsal.  $1\frac{1}{2}$  to 2 phalanges of fourth toe free of web, less than one phalanx of fifth toe free. Length of foot less than length of tibia. Top of snout lighter, forming a clearly defined triangular patch. No light vertebral band, no light line on upper surface of tibia. Light markings on posterior face of thigh forming parallel longitudinal bands, with heavy dark bordering. Lower jaw marbled to continuously darkened.

**Habitat.** Very common in lowland savanna, this species is usually found near water, the adults taking cover in grass or river debris during the day. It can tolerate seasonal drying of rivers in sandveld.

*Remarks.* Perret (1976, 1979) has pointed out that *superciliaris* Günther is a west African sylvicolous species, and that the name has been incorrectly applied to *anchietae* by Schmidt & Inger (1959) and subsequently by Poynton (1970).

*Distribution.* Savanna from Ethiopia to Natal, across to Angola.

*Localities.* BOTSWANA. Francistown (NMZB), Gugathebe Bridge (TM), Kanye (NMZB), Kasane (TM), Lobatse (MM), Mahalapye (MM), Metsemotlhaba River (TM), Sikwane (NMZB). CAPRIVI. Katima Mulilo (TM), 11 km E Katima Mulilo (TM), Old Sangwali (TM). ZAMBIA. Chavuma (NMZB), Cheta River (NMZB), Chibembe dist. (BM), Chikwa (NMZB), Chilanga (FMNH, NMZB), Chilola River, Chipopo (BM), Chipata (NMZB), Chiwanda (BM), Chunga Camp (NMZB), Kachalola (AMNH), Kalichero (NMZB), Kalomo (NMZB, NMZL), Katete/Lupande (NMZB), Kazungula (NMZB), Kotonta Pool, Victoria Falls (BM), Livingstone (BM, NMZL), Luembwe/Luangwa (NMZB), Lusaka West (NMZB), Maiyumba (BM), Monze (NMZL), Mpulungu (PEM), Munyamadzi River (BM), Petauke Old Boma (NMZB), Sala Reserve (NMZB), Sasare (NMZB), Sesheke (NMZL), Siantamba (NMZB), Sitwe (NMZB), Zungwala (BM). MALAWI. Chikwawa (NM), Chipoka (AJL), Karonga (NMZB), Kondowe-Karonga (BM), Likabula (NMZB), Lujeri (NMZB), Monkey Bay (BM), Ngara (NMZB), Nyungwe (NMZB), Rumpi (NMZB), Salima (NMB), Wamkurumadzi Bridge (NMZB), Zomba Mountain (BM). Limbe; Mtimbuka; Zomba (Loveridge 1953a), Chirombezi Creek; Chiromo; Mangoche; Mpatamanga Gorge (Loveridge 1953b), Bwaye River; Dedza; Likabula Rest House; Mzimba (Stewart 1967). MOZAMBIQUE. Alves de Lima (NMZB), Amatongas (BM), Beira (NM), Boane (NMZB), Boroma (NMZB), Cavalo (NMZB), Changara (NMZB), Charre (BM), Chimonzo (DM, NMZB, TM), Chinamainza (NMZB), 19 km S Erego (NMZB), Espungabera (NMZB), Estatuané (NMZB), Gondola/Gorongosa Pontoon (NMZB), Gorongosa Mountain (NMZB), Gumba (NMZB), Inchope (NMZB), Jorge (NMZB), Lower Pungwe Bridge (NM), 25 km N Lower Revue Bridge (NMZB), Lua River (NMZB), Machipanda (NM), Magasso (NMZB), 15 km SW Magude (NMZB), 8 km E Mapulanguene (TM), Maringa (NMZB), Massangena (NMZB), Mavita (NMZB), Metambanhe (NMZB), Mitucué Mountain (NMZB), Moamba (NMZB), Mogumba (TM), Muandzane (NMZB), Nabaunama Dam (NMZB), Namuava (NMZB), Ponta de Ouro (TM), Ponte do Calichane (NM), Quelimane (BM), Ribaue Mountain (NMZB), 72 km ENE Tete (NMZB), Upper Pungwe Bridge (NMZB), 10 km E Vila de Manica (NMZB), 15 km SE Vila Franca do Save (NMZB), 16 km ESE Vila Gouveia (NMZB), 10 km NW Vila Pery (NMZB), Viola (NMZB). ZIMBABWE. Bangala Dam (NMZB), 34 km NW Beitbridge (AJL), Bembezi (NMZB), Bengi Spring (NMZB), Bikita (NMZB), Birchenough Bridge (TM), Bomponi (NMZB), Buffalo Bend Pan (NMZB), Charara Confluence (NMZB), Charara Plateau (NMZB), 8 km E Chegutu (NMZB), Chete Gorge (NMZB), Chicomedzi (NMZB), Chipinda Pools (NMZB), Chiredzi River (NMZB), Chiredzi (AJL, NMZB), Chiredzi North (NMZB), Chirisa SA (NMZB), Chirivira Falls (NMZB), Chirundu (NMZB), Chisumbanje (NMZB), Chitora River (NMZB), Corona Farm (NMZB), Craiglee (NMZB), Devuli River (DM), Dunblane (NMZB), Esigodini (AJL, NMZB),



Falcon College (AJL), Fatima (NMZB), Fishan (NMZB), Gatooma (AJL), Gem Farm (AJL), Gokwe/Sanyati C.H.A. (NMZB), Guruve (NMZB), Harare (NMZB), Haroni River (NMZB), Haroni/Rusitu Confluence (NMZB), Hippo Pools (NMZB), Hwange (NMZB), Kadoma (AJL), Kaitano (NMZB), 5 km SW Kamativi (NMZB), Kampoti Rapids (NMZB), Kanyemba (NMZB), Kariba (NMZB), 20 km NNE Kariba (AJL), Kariba Lake (NMZB), Kariba Lake, Nyanyana River mouth (AJL), Katombora (NMZB), Kazuma (NMZB), Kazungula (DM, NMZB), Khami River Ranch (NMZB), Kompoti Rapids (NMZB), KweKwe (AJL, NMZB), Limpopo River (NMZB), Lone Star Ranch (NMZB), Lonely Mine (NMZB), Lower Nuanetsi River (NMZB), Lukosi (NMZB), Lundi River Bridge (NM), Lupane (NMZB), Mabalauta (NMZB), Machinawa Pan (NMZB), Mahenya (NMZB), Majinji Pan (NMZB), Makurupini/Haroni Confluence (NMZB), Makurupini Valley (NMZB), Maleme Dam & River (NMZB), Malonga River Bridge (NMZB), Mana Pools (NMZB), Mangwe Pass (NMZB), Manyoni River (NMZB), Manzituba Camp (NMZB), Marhumbini (NMZB), Matetsi River Bridge (NMZB), Matetsi/Zambezi Confluence (NMZB), Matusadona Beacon (AJL), Matusadona NP (NMZB), Mpata Gorge (NMZB), Mucheni Gorge (NMZB), Murewa (NMZB), Mutare (NMZB, NM), 6 km W Mutoko (NMZB), Mutoko (NM), Mupata Gorge (NMZB), 6 km ESE Mupudzi Bridge (NMZB), Mutemwa (NMZB), Mwenda Confluence (East)/Kariba (NMZB), Mwenezi (NMZB), Namakurwe River (NMZB), Ngezi Dam (NMZB), Ngorima C.L. (East) (NMZB), Nkayi (NMZB), Nyadekese Dam (NMZB), Nyamakari River (NMZB), 16 km WSW Nyamandhlovu (NMZB), Nyamashato River (NMZB), Odzi (NMZB), Old Umtali (NMZB), Plumtree (NMZB), 48 km NNW Plumtree (NMZB), Pungwe Bridge (NMZB), Ranelia (NMZB), Razi (NMZB), Ruenya River Drift (NMZB), Rukute Farm (NMZB), Runde C.L. (NMZB), Rupisi Hot Springs (NMZB), Ruware (NMZB), Sabi River (NMZB), Sabi River, 32 km from Sabi/Lundi Confluence (AJL), Sabi-Lundi Confluence (AJL), Sable Park (NMZB), Samalema Gorge (NMZB), Sengwa Gorge (NMZB), Sengwa/Kove Confluence (NMZB), Sengwa River (NMZB), Sengwa West (NMZB), Sentinel Ranch (NMZB), Shashi Irrigation Scheme (NMZB), Shashi/Shashani Confluence (NMZB), Shoka Farm (NMZB), Silverstreams (NMZB), Sinamatela (NMZB), Siyanje (NMZB), Stapleford (NMZB), Tegwani (NMZB), The Corner (NMZB), Tivule Spring (NMZB), Toghwana Dam (NMZB), Triangle (NMZB), Tshakabika Hot Spring (NMZB), Turk Mine (NMZB), Umfuli River Bridge (AJL), Victoria Falls (BM), Wedza (NMZB), West Sebungwe (NMZB), Whitewaters (NMZB), Zambezi River, 32 km WNW Victoria Falls (NMZB), Zambezi/Charara Confluence (NMZB), Zambezi/Chewore Confluence (NMZB), Zambezi/Sapi Confluence (NMZB), Zambezi Camp (NMZB), Zambezi N.P. (NMZB), Zambezi River, 20 km NNE Kariba (AJL), Zimbabwe Ruins (NMZB).

*Ptychadena obscura* (Schmidt & Inger)

*Rana obscura* Schmidt & Inger 1959: 85. Kaziba, Parc Nationale de l'Upemba, Zaïre. Holotype in the Musée Royal de l'Afrique Centrale, Tervuren.

*Ptychadena obscura* Schmidt & Inger, Poynton 1970: 369, Broadley 1971: 115.

**Diagnosis.** Distance from nostril to snout tip approximately equal to internarial distance, less than distance from nostril to eye. Gular pouch slits ending level with

lower edge of arm insertion. Outer metatarsal tubercle usually at least feebly developed, row of tubercles present under fourth metatarsal. 2 to 3 phalanges of fourth toe free of web,  $\frac{1}{2}$  to 1 phalanx of fifth toe free. Length of foot slightly less than length of tibia, occasionally equal. Top of snout lighter, forming a clearly defined triangular patch. No light vertebral band, no light line on upper surface of tibia. Dark transverse bands tending to fade on upper surface of tibia. Posterior face of thigh with a few indistinct light spots or interrupted lines, normally no longitudinal darker lines or bands. Lower jaw continuously or almost continuously darkened.

*Habitat.* According to Vesey-FitzGerald's labels, the FMNH Mbala series was collected from a 'woodland floor', and the Lake Chila specimen from the 'grassy wet verge of lake'.

*Remarks.* The FMNH series of four specimens from Mbala comprise two typical specimens and two with several indistinct series of dark spots on the back, falling well within the range of variation of *anchietae*, and also showing faint *anchietae*-like light bands or series of spots on the posterior face of the thigh, with dark bordering. This suggests either incomplete separation of *obscura* and *anchietae* as species, or else subsequent hybridisation, possibilities which seem to require investigation.

*Distribution.* Upemba National Park, Zaïre, and northern areas of Zambia.

*Localities.* ZAMBIA. Chilongowelo (FMNH), Lake Chila (FMNH), Mambwe (PEM), Mbala (FMNH), Sakeji (NMZB).

*Ptychadena mascareniensis mascareniensis* (Duméril & Bibron)

*Rana mascareniensis* Duméril & Bibron 1841: 350. Mascarene and Seychelles Islands. Syntypes in the Muséum National d'Histoire Naturelle, Paris. Loveridge 1933: 369 & 1953a: 370 & 1953b: 148.

*Ptychadena mascareniensis mascareniensis* (Duméril & Bibron), Poynton 1964a: 128 & 1964b: 207 & 1970: 369, Stewart 1967: 71, Broadley 1971: 115, Stevens 1974: 7.

*Diagnosis.* Distance from nostril to snout tip equal to, or slightly more than, internarial distance, equal to distance from nostril to eye. Gular pouch slits ending above level of arm insertion. No outer metatarsal tubercle, no row of tubercles under fourth metatarsal. 2 to (rarely)  $2\frac{1}{2}$  phalanges of fourth toe free of web,  $\frac{1}{2}$  to 1 phalanx of fifth toe free. Length of foot equal to, to greater than, length of tibia. Typically a light mid-dorsal band running from snout to vent, sometimes replaced by a thin line or more rarely absent. Longitudinal light line present on upper surface of tibia. Dark transverse bands tending to fade on upper surface of tibia. A continuous to diffuse dark band running from knee to knee below vent, more conspicuous in juveniles. Posterior face of thigh with somewhat irregular light longitudinal bands and contrasting dark bands. Lower jaw marbled.

*Habitat.* Associated with swamps and marshes in open savanna (in contrast to the more sylvicolous *m. bibroni*, Perret 1979).

*Distribution.* Savannas from Sierra Leone to Egypt to Natal, but distribution patchy in areas where swamps are uncommon. Also Madagascar, Mascarene and Seychelles Islands.

*Localities.* BOTSWANA. Four Rivers Camp (NMZB), Gomoti River (NMZB), Gumare (NMZB), 25 km NE Gumare (NMZB), Khumaga (NMZB), Khwai River

(NMZB), Maun (NMZB), 35 km from Moremi South Gate (TM), Nokaneng (TM), Savuti River (NMZB), Sehitwa (NMZB), Sepopa (TM), Toteng (TM), Xaxaba (NMZB), Xhenga Island (TM). CAPRIVI. Between Okavango and Kwando Rivers (TM), Lake Liambezi (NMZB). ZAMBIA. Chibwe (NMZB), Chilanga (NMZB), Chunga (NMZB), Kandalila Falls (NMZB), Kasama (NMZB), Lake Chila (NMZB), Livingstone (AMNH), Lucheche (BM), Lufupa River (FMNH), Mansa (NMZL), Marshi (FMNH), Masozhi (FMNH, NMZB), Mazabuka (NMZB), Mbete Bay (BM), Monze (NMZL), Mpika (FMNH), Mpulungu (BM, PEM), Mweru Wantipa (BM), Ngoma (NMZB), Niamkolo (BM, MCZ). MALAWI. Lake Chiwondo (NMZB), Mchenga (NMZB), Ngara (NMZB), Palm Beach (TM), Dedza; Karonga/Kondowe (Loveridge 1953a), Chipata; Chirombedzi Creek; Lake Chilwa (Loveridge 1953b), Deep Bay; Kambwe; Karonga; Nkhota Kota; Ruarwe (Stewart 1967). MOZAMBIQUE. Beira (NM, NMZB), Boane (NMZB), Charre (BM), Chimonzo (DM, TM), Inhaca Island (NMZB), 8 km E Jangamo (TM), Macia (DM), Macuti (NMZB). ZIMBABWE. Kazungula Ranch (DM), Zambezi/Chewore Confluence (NMZB).

*Ptychadena porosissima* (Steindachner)

*Rana porosissima* Steindachner 1867: 18. Angola. Holotype in the Naturhistorisches Museum, Vienna. *Rana mascareniensis mascareniensis*; FitzSimons (part) (not Duméril & Bibron) 1958: 213. *Ptychadena porosissima* (Steindachner), Poynton 1964a: 129 & 1964b: 207 & 1970: 370, Stewart & Wilson 1966: 300, Stewart 1967: 74, Broadley 1971: 115.

**Diagnosis.** Distance from nostril to snout tip equal to internarial distance, equal to, to slightly greater than, distance from nostril to eye. Gular pouch slits ending level with lower edge of arm insertion. Outer metatarsal tubercle absent to feebly developed, a row of tubercles under fourth metatarsal sometimes present. 3 phalanges of fourth toe free of web, 1 to 1½ phalanges of fifth toe free. Length of foot slightly less than length of tibia. Light dorsal line or band present from tip of snout to vent. Usually conspicuous light longitudinal line present on upper surface of tibia. Posterior face of thigh usually with distinct light spots arranged in longitudinal rows, but tending to be indistinct in some populations. Lower jaw marbled, tending to be uniformly darkened in northern material.

**Habitat.** Open grasslands, breeding in pools or dambos.

**Distribution.** Ethiopia and Uganda to the eastern Cape, across to Angola, occurring more in cooler regions.

**Localities.** ZAMBIA. Chilongowelo Farm (BM), Chinsali (BM), Lake Chila (BM), Mambwe (PEM), Masozhi (NMZB), Mayau River (AMNH), Nyambela Plain (NMZB), Salujinga (AMNH), Sanduala Plain (NMZB). MALAWI. Chelinda Bridge (NMZB), Lake Chilwa (NMZB), Limphasa Dambo (NMZB). ZIMBABWE. Atlantica E.R.S. (AJL), Audley End Farm (AJL), Chishawasha (AM), Darwendale (AJL), Gulati C.L. (NMZB), Gwebi Agricultural College (NMZB), Gweru (AM), Harare (AJL, AM), Inyanga dist. (TM), Karoi (NMZB), Mare Dam (NMZB), Matopo Mission (NMZB), Mount Hampden (NMZB), Retreat Farm (NMZB), Rhodes Estate Orchards (NMZB), Rusape (AM), Saffron Walden (AJL), Selborne (NMZB), Shavanhohwe River Waterfall (AJL), Sote

Source (NMZB), Stapleford (NMZB), Togwe Wild Area, Matopos N.P. (NMZB), Udu Dam (NMZB), Victoria Falls (TM), Zimbabwe Ruins (NMZB).

*Ptychadena grandisonae* Laurent

*Ptychadena grandisonae* Laurent 1954: 11. Muita, Angola. Holotype deposited in the Dundo Museum. Poynton 1970: 370, Broadley 1971: 115.

**Diagnosis.** Distance from nostril to tip of snout more or less equal to internarial distance and distance from nostril to eye. Gular pouch slits ending below level of arm insertion. Outer metatarsal tubercle conspicuous to barely present, a row of tubercles under fourth metatarsus present, but sometimes weakly developed. 3 (sometimes slightly less) phalanges of fourth toe free of web, 1 to  $1\frac{1}{2}$  phalanges of fifth toe free. Length of foot very slightly less than length of tibia. Light dorsal line or band usually present from snout to vent. No light longitudinal line on tibia. Posterior face of thigh with longitudinal series of light spots which tend to run together, or short bands, or a continuous light band but with wavy, irregular margins. Lower jaw marbled.

**Habitat.** Moist upland savanna. A specimen was collected in a grassland bog near the Zambezi rapids (Mwinilunga district) in association with *P. uzungwensis*.

**Distribution.** Northeastern Angola, northern Zambia, eastern Zaïre, Rwanda.

**Localities.** ZAMBIA. Chilongoma (FMNH), Kalabo (FMNH), Lake Chila (BM, FMNH), Lucheche (BM), Mbala (BM), Senanga dist. (FMNH), Uningi (FMNH), Zambezi Rapids (NMZB).

*Ptychadena upembae* (Schmidt & Inger)

*Rana upembae* Schmidt & Inger 1959: 111. Kaswabilenga, Upemba National Park, Zaïre. Holotype in the Institut royal des Sciences naturelles de Belgique.

*Ptychadena upembae* (Schmidt & Inger), Poynton 1964b: 207 & 1970: 370, Stewart 1967: 76, Broadley 1971: 115, Stevens 1974: 7.

**Diagnosis.** Distance from nostril to snout tip more or less equal to internarial distance and distance from nostril to eye. Gular pouch openings ending level with lower edge of arm insertion. Outer metatarsal tubercle and row of tubercles on fourth metatarsal usually present. 3 phalanges of fourth toe free of web,  $1\frac{1}{2}$  to 2 phalanges of fifth toe free. Length of foot slightly less than length of tibia. Light vertebral line or band usually present. No light line on upper surface of tibia. Posterior face of thigh of usually at least one leg with at least one continuous light band running entire length, bordered usually on both sides by a continuous dark band (although on other leg the light band may be interrupted in several places). Lower jaw uniformly darkened, occasionally with interruptions.

**Habitat.** No data available.

**Distribution.** Malaŵi, Zambia, Shaba (Zaïre), Angola.

**Localities.** ZAMBIA. Chipangali (NMZB), 38 km E Chipata (NMZB), Kasama (BM), Lunsemfwa (BM), Sandaula Plain (NMZB), Sayiri Court (NMZB), Senje Hill (NMZB). MALAŴI. Chisambo (NMZB), Livingstonia (NMZB). MOZAMBIQUE. Fingoe (TM).

*Ptychadena uzungwensis* (Loveridge)

*Rana mascareniensis uzungwensis* Loveridge 1932: 384. Dabaga, Tanzania. Holotype in the Museum of Comparative Zoology, Harvard.

*Rana mascareniensis mascareniensis*; FitzSimons (part) (not Duméril & Bibron) 1958: 213.

*Ptychadena uzungwensis* (Loveridge), Poynton 1964a: 131 & 1964b: 208 & 1970: 371, Stewart & Wilson 1966: 301, Stewart 1967: 77, Broadley 1971: 116, Stevens 1974: 7.

**Diagnosis.** Distance from nostril to snout tip slightly greater than internarial distance, usually slightly greater than distance from nostril to eye. Gular pouch slits ending at the middle of the arm insertion. Outer metatarsal tubercle usually absent, sometimes present as a feeble bump, row of tubercles under fourth metatarsal usually present, but sometimes very weakly developed. 3 phalanges of fourth toe free of web, 1 to  $1\frac{1}{2}$  phalanges of fifth toe free. Length of foot equal to, to (usually) slightly less than length of tibia. A pair of short skin folds anterior to upper eyelids, converging towards snout and usually continuous with paravertebral folds, overlain by darker skin. A light dorsal line usually passing from snout tip to vent. No light line on upper surface of tibia. Posterior face of thigh with light spots, tending to coalesce in proximal half to form a light band. Lower jaw marbled.

**Habitat.** Grasslands, occurring in dambos and permanent sponges.

**Distribution.** Upland areas of Mozambique through Zimbabwe and Zambia to eastern Angola, northwards to Rwanda, Burundi and Tanzania.

**Localities.** ZAMBIA. Ikelenge (NMZB), Kachalola (AMNH), Kalabo (NMZB), Kalungu (BM), Kasama (NMZL), Lake Chila (BM), Luwingu (BM), Mbala (FMNH), Mungwi (BM), Nantumba (NMZB), Salujinga (AMNH), Sayiri Court (NMZB). MALAWI. Chelinda Depot (NMZB), Chisenga (NMZB), Chitipa (NMZB), Lake Chilwa (NMZB), Livingstonia (NMZB), Nkhata Bay (NMZB), Zomba Plateau (NMZB), Lichenya Plateau (Loveridge 1953a). MOZAMBIQUE. Makurupini Valley (NMZB), Martins Falls (NMZB), Vila de Manica (NMZB), 12 km SSE Vila Gouveia (NMZB). ZIMBABWE. Bangala Dam (NMZB), Bikita (NMZB), Bundi River and Valley (NMZB), Chimanimani Mountains East & South East (NMZB), Chimanimani Mountains West (NM, NMZB), Chipinge (NMZB), Concession (NMZB), Gleneagles (NMZB), Gulati C.L. (NMZB), Harare (SAM), Haroni/Rusitu Confluence (NMZB), Inyanga dist. (TM), Karoi (NMZB), Lower Mtarazi River (NMZB), Mare Dam (NMZB), Matopo Mission (NMZB), Merrywaters Farm (NMZB), Msorodoni (NMZB), Musirizwi River (NMZB), Savanhohwe/Nyagui Confluence (AJL), Selborne (NMZB), Sote Source (NMZB), Stapleford (NMZB), Togwe W.A. (NMZB), Udu Dam (NMZB), Zimbabwe Ruins (NMZB), Marondera (Laurent 1954).

*Ptychadena broadleyi* Stevens

*Ptychadena broadleyi* Stevens 1972: 1. Muluzi River, Mulanji Mountain, Malawi. Holotype in the National Museum, Bulawayo. Stevens 1974: 7.

**Diagnosis.** Distance from nostril to snout tip equal to internarial distance and distance from nostril to eye. Gular pouch slits ending level with lower edge of arm insertion. Outer metatarsal tubercle weakly to (usually) well developed, a row of tubercles under fourth metatarsal present but weakly developed.  $2\frac{2}{3}$  to 3 phalanges

of fourth toe free of web, 1 to slightly less of fifth toe free. Length of foot equal to, to less than, length of tibia. A pair of short skin folds anterior to upper eyelids, converging towards snout; a separate pair between the eyes, and an occipital pair which may or may not be continuous with the paravertebral pair. A light dorsal line (but not a band) usually present from snout to vent. No longitudinal line on tibia. Posterior face of thigh with two longitudinal series of light spots or short to long bands. Lower jaw with a continuous dark band, to one or more breaks in the band, to somewhat marbled (but not as broken as in *uzungwensis*).

*Habitat.* A rupicolous species, found on open rock faces. During the day the frogs conceal themselves in clumps of vegetation growing out of cracks in the rock surface or around the periphery, emerging at night. Tadpoles develop on rock faces covered by a film of water (Stevens 1972).

*Localities.* MALAWI. Muluzi River, Mulanji (NMZB), Zomba Plateau (NMZB).

#### *Ptychadena ansorgii* (Boulenger)

*Rana ansorgii* Boulenger 1905: 107. Between Benguella and Bihé, Angola. Holotype in the British Museum (N.H.), London.

*Ptychadena ansorgii* (Boulenger), Poynton 1970: 371, Broadley 1971: 116.

*Diagnosis.* Distance from nostril to snout tip more or less equal to internarial distance and distance from nostril to eye. Gular pouch slits ending level with lower edge of arm insertion. Outer metatarsal tubercle usually absent, with or without a row of tubercles under fourth metatarsal. Three to  $3\frac{1}{2}$  phalanges of fourth toe free of web, 2 phalanges of fifth toe free. Length of foot equal to more than length of tibia. Light mid-dorsal line usually present, occasionally a light band. No light line on upper surface of tibia. Posterior face of thigh with light spots, usually arranged in longitudinal rows. Lower jaw with continuous dark band.

*Habitat.* Evergreen forest and moist savanna.

*Distribution.* Northern Zambia, Shaba (Zaire), Angola.

*Localities.* ZAMBIA. Mpulungu (PEM), Niamkolo (BM).

#### *Ptychadena bunoderma* (Boulenger)

*Rana bunoderma* Boulenger 1907: 214. Caconda, Angola. Holotype in the British Museum (N.H.), London.

*Ptychadena bunoderma* (Boulenger), Poynton 1970: 372.

*Description.* Distance from nostril to snout tip greater than internarial distance, slightly less than distance from nostril to eye. Gular pouch slits ending level with lower edge of arm insertion. Outer metatarsal tubercle absent to weakly developed, row of tubercles weakly developed under fourth metatarsal. Four phalanges of fourth toe free of web,  $2\frac{1}{2}$  to 3 phalanges of fifth toe free. Length of foot equal to slightly less than length of tibia. Light vertebral line sometimes present, no light line on upper surface of tibia. Posterior face of thigh with dense scattering of light spots. Lower jaw mainly dark but with light spots or invasions.

*Habitat.* No data available.

*Distribution.* Northwestern Zambia, Angola.

*Locality.* ZAMBIA. 29 km N Mwinilunga (AMNH).

*Ptychadena taenioscelis* Laurent

*Rana mascareniensis uzungwensis* (not Loveridge 1932), Loveridge 1953a: 372.

*Ptychadena taenioscelis* Laurent 1954: 25. Lukula, Zaïre. Holotype in the Musée Royal de l'Afrique Centrale, Tervuren. Poynton 1964a: 132 & 1964b: 208 & 1966: 19 & 1970: 372, Stewart 1967: 81, Broadley 1971: 116. Stevens 1974: 7.

*Diagnosis.* Distance from nostril to snout tip greater than internarial distance, equal to, to slightly greater than, distance from nostril to eye. Gular pouch openings ending at the middle of the arm insertion. Outer metatarsal tubercle absent (rarely a feeble bump), no row of tubercles under fourth metatarsal. Three (rarely less) phalanges of fourth toe free of main webbing, 1 phalanx (sometimes slightly more) of fifth toe free. Length of foot slightly greater than length of tibia. Pair of dorsal skin folds usually passing onto snout, and overlain by darker skin. A light vertebral line or band usually present (less common in eastern material). Light line on upper surface of tibia well marked to absent (more reduced in eastern material). Posterior face of thigh with conspicuous light and dark longitudinal banding, one dark band running transversely below vent almost from knee to knee. Lower jaw heavily marbled and throat usually spotted.

*Habitat.* Grasslands to moist woodlands, common locally in dambos.

*Remarks.* Perret (1979) has assigned records of *taenioscelis* from west and central Africa to *pumilio* Boulenger, which he believes has probably a subspecific relationship with *taenioscelis*. He (in litt.) disputes the correctness of placing *smithi* Guibé in the synonymy of *taenioscelis*, proposed by Poynton 1964a. The *pumilio-taenioscelis-smithi* complex shows a very patchy distribution in the field, being locally very common but absent over wide areas, which makes vicariance likely. The nomenclatural handling of the disjunct units will be unlikely to enjoy consensus among taxonomists.

*Distribution.* In the strict sense (see Remarks), northern Mozambique, Malawi, Zambia, northern Botswana, Angola, southeastern Zaïre, Tanzania.

*Localities.* BOTSWANA. Four Rivers Camp (NMZB), Gugathebe Bridge (TM), Khwai Camp (NMZB), Toromoja (NMZB). ZAMBIA. Angola border, east of Kalabo (NMZB), Busanga Lufura (FMNH), Chongwe River (NMZB), Chunga (NMZB), Kalabo (AMNH, FMNH, NMZB), Kalenga (NMZB), Kalomo (NMZB), Kalungu River (BM), Kasama (NMZL), Lake Chila (BM), Liuwa Plain (NMZB), Lufupa (FMNH), Lukulu River (BM), Marshi (FMNH), Mbala (BM, FMNH, NMZB), Mkushi District (NMZB), Mtikila (NMZB), Mundwiji Plain (NMZL), Mungwi (BM), Mutenda (FMNH), Ngambwe Falls (NMZB), Ngoma (NMZB), Niamkolo (BM), Roma (BM), Salujinga (AMNH), Sandaula Plain (NMZB), Sayiri Court (NMZB), Senanga dist. (FMNH), Sesheke (NMZL). MALAWI. Chisambo Estate (NMZB), Limphasa Dambo (NMZB), Nkhata Bay (NMZB); Lichenya Plateau (Stewart 1967), Palombe-Tuchila-Chilwa Plain; base of Mulanje Mountain (Stevens 1974). MOZAMBIQUE. Nampula (NMZB).

*Ptychadena guibei* Laurent

*Rana mascareniensis*, Boulenger (not Duméril & Bibron) 1907a: 481.

*Rana ansorgii*; Parker (not Boulenger) 1930: 898.

*Ptychadena chrysogaster guibei* Laurent 1954: 23. Muita, Angola. Holotype in the Dondo Museum. Poynton 1964a: 133 & 1964b: 208 & 1966: 19 & 1970: 372, Stewart 1967: 83, Broadley 1971: 116, Stevens 1974: 7.

**Diagnosis.** Distance from nostril to snout tip about equal to internarial distance and distance from nostril to eye. Gular pouch openings ending level with lower edge of arm insertion. Outer metatarsal tubercle well to very weakly developed, row of tubercles usually present under fourth metatarsal. Three to  $3\frac{1}{2}$  phalanges of fourth toe free of web,  $1\frac{1}{2}$  to 2 phalanges of fifth toe free. Length of foot equal to or greater than length of tibia. Paravertebral folds typically not reaching tip of urostyle: a more medially placed para-urostyle pair continues to vent. In some specimens the right or—more usually—left urostyle fold is continuous with the vertebral fold of its side. In Botswana and Zambia the folds tend to be continuous from eye to urostyle tip on both sides, but usually there is a fold tending to be placed slightly right of the midline. Light dorsal band present from snout tip to vent. Longitudinal light line on upper surface of tibia present to absent. Cross-banding on upper surface of tibia tends to fade to uniform light coloration. Posterior face of thigh with regular light and dark bands. Lower jaw with almost continuous dark shading. Ventral pectoral skin sometimes with light freckling.

**Habitat.** Moist grassland or savanna, occasionally common in dambos. The species was found in grassy glades in the Rusitu Forest, eastern Zimbabwe, where it was associated with *Strongylopus grayii rhodesianus*.

**Distribution.** Scattered localities in Mozambique, Zimbabwe, Malaŵi, Zambia, northern Botswana, Angola, Shaba (Zaire).

**Localities.** BOTSWANA. Gumare (NMZB). ZAMBIA. Chilavi (BM), Chunga (NMZB), Kabwe (FMNH), Lake Chila (NMZB), Mayau River (AMNH), Mbala (FMNH), Mpulungu (PEM), Mutenda (FMNH), Sandaula Plain (NMZB), MALAŴI. Kapalassa (BM), Lilongwe (NMZB), Limphasa Dambo (NMZB), Nkhata Bay (NMZB), Chiradzulu Mountain; Lichenya Plateau; Likabula River (Loveridge 1953a), Chirombedzi Creek; Lake Chilwa (Loveridge 1953b), Njakwa; Vwaza Marsh (Stewart 1967). MOZAMBIQUE. Amatongas (BM), Beira (BM), 13 km & 16 km NE Beira (NMZB), Chiniziua District (NMZB), Dondo & 8 km NE Dondo (NMZB), Ibo Island (BM), Manga (NMZB), Mossuril (NMZB), Ribaué Mountain (NMZB), Vila de Manica & 10 km E of (NMZB), 8 km NW Vila Pery (NMZB). ZIMBABWE. Ngorima Reserve (East) (NMZB), Rusitu Forest (NMZB), Victoria Falls (BM, TM).

*Ptychadena keilingi* (Monard)

*Rana (Ptychadena) keilingi* Monard 1937: 53. Dala, Angola. Holotype in the Muséum d'Histoire Naturelle, Geneva. Poynton 1970: 373, Broadley 1971: 116.

**Description.** Distance from nostril to snout tip equal to internarial distance, less than distance from nostril to eye. Outer metatarsal tubercle usually weakly developed, row of tubercles present under fourth metatarsal.  $3\frac{3}{4}$  to 4 phalanges of fourth toe free of main webbing,  $2\frac{1}{2}$  to almost 3 phalanges of fifth toe free. Length



of foot slightly greater than length of tibia. Light dorsal band present from snout to vent. Light line usually present on upper surface of tibia. Posterior face of thigh with irregular light and dark longitudinal banding. Lower jaw continuously darkened, but sometimes containing a few light spots. Throat and chest spotted.

*Habitat.* At Ikelenge, Zambia, three specimens were collected in dambos in savanna woodland in association with *P. uzungwensis*.

*Distribution.* Western Zambia and Angola.

*Localities.* ZAMBIA. Ikelenge (NMZB), Isombo Stream (NMZB).

### *Ptychadena mossambica* (Peters)

*Rana mossambica* Peters 1854: 626 (part). Tete; Boror; Cabaceira; Quelimane, Mozambique. Lectotype in the Zoologisches Museum, Berlin.

*Rana trinodis*; Pfeffer (not Boettger) 1893: 90.

*Rana vernayi* FitzSimons 1932: 39. Metsemotlhaba River, Botswana. Holotype in the Transvaal Museum, Pretoria. FitzSimons 1935: 383.

*Rana mascareniensis*, FitzSimons (not Duméril & Bibron) 1939: 40.

*Rana mascareniensis mossambica* Peters, Loveridge 1953a: 371 & 1953b: 148.

*Ptychadena vernayi* (FitzSimons), Poynton 1964a: 135 & 1964b: 209.

*Ptychadena mossambica* (Peters), Poynton 1966: 19 & 1970: 373, Stewart 1967: 85, Broadley 1971: 116, Stevens 1974: 8.

*Diagnosis.* Distance from nostril to snout tip less than internarial distance, less than to (rarely) equal to distance from nostril to eye. Gular pouch slits ending level with lower edge of arm insertion. Outer metatarsal tubercle and row of tubercles under fourth metatarsal feebly to well developed. In eastern part of range,  $2\frac{2}{3}$  to 3 phalanges of fourth toe free of web, 1 phalanx (sometimes slightly more) of fifth toe free. Webbing more extensive in western part of range (see Remarks). Length of foot less than length of tibia, typically less than half length of body. Paravertebral folds typically do not reach tip of urostyle, but are replaced by a para-urostylar pair, although frequently the paravertebral fold of one side is continuous with the para-urostylar fold. Usually a light dorsal band from snout tip to vent present, but sometimes absent. Well developed to irregular longitudinal light line on upper surface of tibia occasionally present, especially in eastern part of range. Posterior face of thigh mottled, to showing irregular light longitudinal bands. Lower jaw marbled or barred, not uniformly darkened.

*Habitat.* A savanna species, often associated with *P. anchietae*, but specimens have been collected in evergreen forest at Dondo, near Beira. Typically breeding in open dambos or flood plains.

*Remarks.* This species shows an east-west cline, most notably in size and degree of webbing. Males collected in Mozambique attain a body length up to 44 mm, while four males in breeding condition in a FMNH series from Marshi, western Zambia, show a size range from 28.9 mm to 26.8 mm. Males collected from intermediate areas show intermediate size. The largest female collected in Mozambique (Mossuril, NMZB) has a body length of 52.5 mm, while the two Marshi females are 32.8 mm and 31.1 mm. The webbing specified in the Diagnosis does not apply to all Zambian material, particularly to the western Marshi series, where only  $2\frac{1}{3}$  phalanges of the fourth toe are free of the main webbing in one specimen, and in none are all three phalanges free. In no specimen is the first phalanx of the fifth toe

wholly free. Intermediate conditions between the eastern and western extremes are nevertheless shown: in two AJL specimens from near Chisamba, Zambia, for example, virtually only two phalanges of the fourth toe are free of the main webbing in one specimen, but almost three phalanges are free on one foot of the other specimen. The extensively webbed specimen, a 41,5 mm female, keys out to *frontalis* Laurent in both Schmidt & Inger's (1959) and Poynton's (1970) key. Neither of the Chisamba specimens show a dorsal light band, and there seems to be no very clear way of separating extensively webbed specimens from *frontalis* if they lack a band. The situation needs investigating.

*Distribution.* Possibly southern Somalia as *gansi* Laurent (Lanza 1981), Kenya and Uganda through to Botswana, northern and eastern Transvaal, northern Natal.

*Localities.* BOTSWANA. 13 km W Foley (NMZB), Kwikampa (NMZB), Metsemotlhaba River (TM), Okavango Delta (TM). CAPRIVI. Lake Liambezi (NMZB), Muyako (TM), Okavango-Kwando Rivers (TM). ZAMBIA. Chakwenga River (NMZB), 16 km W Chisamba (AJL), Chiwanda (BM), Chunga (NMZB), Kabwe (BM), Kasama (NMZL), Livingstone (NMZL), Lower Lushwishi River (NMZB), Luembwe/Luangwa (NMZB), Marshi (FMNH), Mazabuka (NMZB), Mfuwe (NMZB), Monze (NMZL), Nantumba (NMZB), Ngoma (NMZB, TM). MALAWI. Lilongwe (NMZB), Nchalo (AJL), Ngara (NMZB), Chowe; Marimba; Mtimbuka; Ntchisi Mountain (Loveridge 1953a), Gande Village (Loveridge 1953b), Njakwa (Stewart 1967). MOZAMBIQUE. Bazaruto Island (NMZB), Beira (BM, NMZB), 16 km NE Beira (NMZB), Bela Vista (DM), Boane (NMZB), Caia (BM), Chigubo (NMZB), Chimonso (TM), Chitengo (NMZB), Dondo (NMZB), Estatuane (NMZB), Kasumbadedza (BM, MCZ), Lower Pungwe Bridge (NM), Magude (TM), 15 km SW Magude (NMZB), Manga (NMZB), 8 km E Mapulanguene (TM), Matchova (NMZB), Mossuril (NMZB), Muda/Lamego (NMZB), 10 km SSE Ressano Garcia (NMZB), Sofala (NMZB), 15 km SE Vila Franca do Save (NMZB), Vila Machado (NMZB), Xiluvo (NMZB), Zavora (NMZB), Zinave & 7 km SSW of (NMZB). ZIMBABWE. Bembezi (NMZB), Bengi Spring (NMZB), Birchenough Bridge (TM), Buffalo Bend Pan (NMZB), Bulawayo (NMZB), 16 km SSW Chakari (AJL), 8 km E Chegutu (AJL), Chinhoyi (NMZB), Chipinda Pools (NMZB), Chisumbanje (NMZB), Darwendale (AJL), Gokwe/Sanyati C.H.A. (NMZB), Gonakudzingwa Koppies (NMZB), Gwamayaya River (BM), Harare (AM, MM), Imbesu Park (NMZB), Kadoma (AJL), 10 km E Kariba (AJL), 20 km NNE Kariba (AJL), Kariba Lake/Charara and Chimburu Confluences (NMZB), Kotwa (NMZB), KweKwe (AJL), 15 km NW Lions Den (NMZB), Lochard (NMZB), Lower Nuanetsi River (NMZB), Lukosi (NMZB), Lundi River Bridge (NM), Lupane (NMZB), Lusulu (NMZB), Mabalauta F.S. (NMZB), Machinawa Pans (NMZB), Mahenya (NMZB), Majinji Pan (NMZB), Malugwe Pan (NMZB), Mana Pools (NMZB), Matendere Ruins (NMZB), Mtetengwe River Bridge (NMZB), Mutare (NMZB), Mwenezi (NMZB), Mzarabani C.L. (NMZB), Nyamugwe Pans (NMZB), Razi Dam (NMZB), Rukomeshe (NMZB), Rukute Farm (NMZB), Rupisi Hot Springs (NMZB), Sabi/Lundi Confluence (NMZB), Saffron Walden (AJL), Sazale Pan (NMZB), Sengwa Gorge (NMZB), Sengwa River (NMZB), Sengwa West

(NMZB), Shashi Irrigation Scheme (NMZB), Sinamwenda (NMZB), Teaklands (NMZB), Westwood Vlei (NMZB), Zambezi–Chewore Confluence (NMZB).

*Ptychadena cotti* (Parker)

*Abrana cotti* Parker 1930: 898. Charre, Mozambique. Holotype in the British Museum (N.H.), London. *Ptychadena floweri*; (not Boulenger 1917) Poynton 1917: Poynton 1964a: 136 & 1964b: 209 & 1966: 22 & 1970: 374, Stewart 1967: 87, Stevens 1974: 8.

**Description.** Distance from nostril to snout tip less than internarial distance, less than distance from nostril to eye. Gular pouch slits ending at the middle of the arm insertion. Distinct outer metatarsal tubercle and tubercles under fourth metatarsal lacking. 2 to almost 3 phalanges of fourth toe free of main webbing, 1 or less of fifth toe free. Length of foot equal to, to (usually) less than, length of tibia, subequal to half length of body. Skin folds very interrupted, no continuous folds from occiput to sacrum. No light lines on back or upper surface of tibia. Posterior face of thigh mottled or vermiculated, usually finely so, but sometimes with indications of incomplete longitudinal banding. Lower jaw marbled.

**Habitat.** A savanna species, usually associated with large rivers, lakes and permanent swamps.

**Remarks.** *P. cotti* has usually been placed in the synonymy of *floweri* Boulenger since assigned there by Loveridge (1933). The single type of *floweri*, however, has short feet and tibiae, 41 % and 44 % of the body length respectively, which falls outside the range of the *cotti* type series (46–56 % and 51–57 % respectively). The nostril is placed further back on the snout in *floweri* (snout tip to nostril 85 % nostril to eye) than in *cotti* (not more than 80 %). The *floweri* type has a continuous light band on the left thigh, which is at best barely indicated in *cotti*, where a finely vermiculated or mottled pattern is usual. Ethiopian material in the BM agrees with *cotti* rather than *floweri*.

**Distribution.** Mozambique and Malaŵi to, apparently, Ethiopia.

**Localities.** MALAŴI. Mchenga (NMZB), Chilwa–Tuchila Plain and Shiré Valley (Stevens 1974). MOZAMBIQUE. Beira (BM, NMZB), Boror (NMZB), Charre (BM), Macuti (NMZB), Matchova (NMZB), Muda/Lamego (NMZB), Nova Sofala (NMZB), Kasumbadedza (Loveridge 1953a).

Genus *Phrynobatrachus* Günther

*Stenorhynchus*; Smith (not Hemprich) 1849: 23. Type by monotypy: *S. natalensis* Smith. *Phrynobatrachus* Günther 1862: 190. Type by monotypy: *P. natalensis* Günther. Dubois 1981: 253.

Puddle and Cricket Frogs. Vomerine teeth absent. Omosternum ossified, forked posteriorly, procoracoid-clavicular bar ossified along anterior margin, straight. A small papilla present in the middle of the tongue. Tarsus with a prominent tubercle about half-way along its length. Toes fully to barely webbed.

Africa south of the Sahara, excepting the southwestern Cape and very arid regions. Breeding in shallow, standing water, eggs floating on surface.

The genus contains species which are among the most wide-ranging and abundant of African amphibians. The geographic and intrapopulation variation is

great in such species, and, when combined with only slight morphological differences between species, makes taxonomic analysis within the genus notoriously difficult. The Introduction to Part 1 of this study (Poynton & Broadley 1985) outlined the idea of viewing a species as a hypothesis which is open to testing: in the case of *Phrynobatrachus* the species-hypotheses, currently based mainly on gross morphological features, must be seen as particularly tentative and in need of testing by the use of other features.

Schmidt & Inger (1959) in particular have commented on the indistinctness and inconsistent usage of morphological features in this genus. Regarding webbing, we follow these authors in taking more note of the extent of the main, broad web rather than the extent of the narrow fringe or margin of web that runs along the toes. As Schmidt & Inger point out, the extent of the broad web varies less, relative to the subarticular tubercles, than the extent of the margin along the toes. Colour pattern polymorphism in this genus has been discussed by Stewart 1974 and Milstead, Rand & Stewart 1974.

### *Phrynobatrachus perpalmaris* Boulenger

*Phrynobatrachus perpalmaris* Boulenger 1898: 479. Lake Mweru, Zambia. Syntypes in the British Museum (N.H.), London. Loveridge 1933: 375, Broadley 1971: 117.

**Diagnosis.** Male body length up to 25 mm. Gular sac weakly developed, without folds running in a definite direction; no femoral glands. Tips of toes expanded into small discs with indistinct circummarginal grooves. Broad web extending well beyond level of distal subarticular tubercle of third toe, usually passing beyond level of middle tubercle of fourth toe; margin of web reaching discs of all toes except fourth. Tarsal tubercle virtually a transverse flap with no heavy whitish cornification.

**Description.** Upper jaw light-coloured, at most with faint, irregular marbling; lower jaw with a more or less continuous dark edging. Gular region of males with little or no pigmentation, weakly spotted in females. Posterior face of thigh with at least two prominent light bands, one commencing alongside the vent, the other forming, with the opposite thigh markings, a conspicuous band below the vent from knee to knee. Dorsal skin glands only weakly developed.

**Habitat.** Very abundant in swamped grassland interspersed with reeds at Niamkolo (Loveridge 1933).

**Distribution.** Northern Zambia to Sudan (assuming identification of northern material to be correct).

**Localities.** ZAMBIA. Mabete (NMZB), Mambwe (PEM), Mpulungu (PEM), Niamkolo (BM), Sumbu Bay (NMZB).

### *Phrynobatrachus acridoides* (Cope)

*Staurois acridoides* Cope 1867: 198. Zanzibar Island. Syntypes in the Academy of Natural Sciences, Philadelphia.

*Phrynobatrachus boulengeri* Witte 1918: 225. Beira and Coguno, Mozambique. Syntypes in the British Museum (Natural History), London.

*Phrynobatrachus acridoides* (Cope), Parker 1930: 899, Cott 1932: 480, Poynton 1964a: 140 & 1964b: 210 & 1966: 23, Stewart 1967: 93, Broadley 1971: 117, Stevens 1974: 8.

*Phrynobatrachus perpalmaris*, Loveridge (not Cope) 1953a: 376 & 1953b: 148.

*Diagnosis.* Male snout-vent length up to 28 mm. Gular sac with shallow lateral folds parallel to jaw; no femoral glands. Tips of toes expanded into small discs with indistinct circummarginal grooves. Broad web extending from level of distal subarticular tubercles of third toe to beyond, but not passing beyond level of middle tubercle of fourth toe; margin of web usually falling short of the disc of the third toe, rarely reaching it. Tarsal tubercle a transverse fold of the tarsal ridge with a somewhat compressed spur.

*Description.* Upper jaw usually with light speckling, sometimes with irregular banding, which is more usual on lower jaw. No light subtympenic streak. Gular region of males with continuous shading, not heavily darkened; gular region of females freckled, freckling usually extending over most of belly. Posterior face of thigh usually with a regular, typically conspicuous light longitudinal band which bends anteriorly alongside the vent. Normally a continuous glandular fold running from each eye at least to scapular region, either running obliquely towards middle of back in scapular region or, in specimens with a broad lightish dorsal band, continuing as a border to the band.

*Habitat.* Abundant in more open, lowland pools and ditches.

*Distribution.* Eastern lowlands from northern Natal to Somalia and West Africa. It has recently extended its range onto the eastern escarpment of Zimbabwe.

*Localities.* MALAWI. Chikwawa (TM), Deep Bay (USNM), Fort Worth (BM), Karonga (USNM), Lake Chiwondo (NMZB), Liphassa Dambo (NMZB), Liwonde (NMZB), Mangoche (NMZB), Mbamba Bay (USNM), Mchenga (NMZB), Mpatamanga Gorge (NMZB), Nyungwe (NMZB), Wamkurumadzi Bridge (NMZB), Chitala River; Mtimbuka (Loveridge 1953a), Chiromo; Lake Chilwa; Nkazi River (Loveridge 1953b), Kambwe; Kota Kota; Likoma Island; Nkhata Bay (Stewart 1967). MOZAMBIQUE. Amatongas (BM, NMZB), Beira (BM, NM), 15 km NE Beira (NMZB), Boane (NMZB), Boroma (NMZB), Boror (NMZB), Chapala (NMZB), Charre (BM), Chimonso (DM), Chiniziua dist. (NMZB), Coguno (BM), Dondo & 10 km NW & NNW Dondo (NMZB), Espungabera (NMZB), Fambani River (BM), Gondola–Gorongosa Pontoon (NMZB), Grudja (NMZB), Gumba (NMZB), Ibo Island (BM), Inhambane (DM, SAM), 10 km S Inhanga (NMZB), 10 km W Inhassoro (NMZB), Jofane (NMZB), Jorge (NMZB), Kasumbadeza (MCZ), Lua River Bridge (NMZB), Macia (SAM), Macuti (NMZB), Manga (NMZB), Massangena (NMZB), Metambanhe (NMZB), Metuchira (NMZB), Mhanda (NMZB), Mitucué Mountain (NMZB), 15 km S Muanza (NMZB), Nabaunama Dam (NMZB), Nampula (NMZB), 10 km N Nicuadala (NMZB), Nova Sofala (NMZB), Palane (NMZB), Panda (DM), Ribáuê Mountain (NMZB), Savane (NMZB), 70 km ENE Tete (NMZB), 25 km SE Vila de Manica (NMZB), Vila Fontes (NMZB), 15 km SE Vila Franca do Save (NMZB), Viola (NMZB), Xiluvo (NMZB), Zinave (NMZB). ZIMBABWE. Chiredzi (NMZB), Chisumbanje (NMZB), Fishan (NMZB), Lusitu River (NMZB), Mahenya (NMZB), Marhumbini (NMZB), Mutare (NMZB), Ngorima C.L. (East) (NMZB), Nyahungwe (NMZB), Nyamakari (NMZB).

*Phrynobatrachus natalensis* (Smith)

*Stenorhynchus natalensis* Smith 1849: 23. 'the country around Port Natal', ie. Durban. Holotype in the British Museum (N.H.), London.

*Phrynobatrachus natalensis* Günther 1862: 190. Port Natal, ie. Durban.

*Phrynobatrachus natalensis* (Smith), Günther 1864: 480, Peters 1882: 156, Boulenger 1902: 15, Parker 1930: 899, FitzSimons 1935: 390 & 1939: 41, Loveridge 1953a: 379 & 1953b: 149, Inger 1959: 521, Poynton 1964a: 137 & 1964b: 209 & 1966: 23, Stewart 1967: 91 & 1974: 826, Broadley 1971: 117, Stevens 1974: 8.

*Arthroleptis moorii* Boulenger 1898: 479. 'Kinyamkolo' (ie. Niamkolo), Zambia. Holotype in the British Museum (N.H.), London.

*Phrynobatrachus maculatus* FitzSimons 1932: 40. Rain Forest, Victoria Falls, Zimbabwe. Holotype in the Transvaal Museum, Pretoria.

*Phrynobatrachus duckeri* Loveridge 1953a: 377. Chitala River, Malawi. Holotype in the Museum of Comparative Zoology, Harvard.

**Diagnosis.** Male snout-vent length up to 32 mm. Gular sac with deep lateral folds parallel to jaw; no femoral glands. Tips of fingers and toes usually swollen, but not expanded into discs. Broad web usually extending to level of distal subarticular tubercle of third toe in eastern material, in western material just falling short in about a third of specimens (see Remarks); passing half way or more (rarely less) between proximal and middle tubercle of fourth toe at least on one side; not quite reaching to just passing distal tubercle of fifth toe. A broad to narrow margin of web along outer surface of penultimate phalanx of third toe, and passing middle tubercle of the fourth (sometimes only as a narrow fringe). Tarsal tubercle a transverse fold with stoutly developed, somewhat compressed spur.

**Description.** Upper jaw irregularly barred, lower jaw barred to continuously darkened, no light subtymppanic streak. Gular region of male with continuous darkening; gular region of female speckled, more heavily towards pectoral region, where paired dark patches may be developed. In western material there is a tendency for speckling to extend over the whole venter in both sexes. Posterior face of thigh marbled to possessing an irregular light longitudinal band which bends anteriorly alongside the vent, where it might be conspicuous. Dorsal skin glands mainly rounded, often very numerous and giving a warty appearance, but not forming a continuous longitudinal fold behind the eye, even though occasionally there is a series of elongated glands bordering (if present) a broad light dorsal band.

**Habitat.** Abundant in savanna and grassland (except in the eastern lowlands), mainly associated with permanent or near-permanent shallow water.

**Remarks.** Variation in the degree of webbing is considerable in Zambesiaca and Natal *natalensis*. In its most reduced condition, the broad web is incised slightly deeper than the level of the distal tubercle of toes three and five. This extreme condition is shown in *natalensis* from Natal north to Malawi and west to western Zambia; it is very rare in eastern material, however, although less rare (c. 33 %) in western series. In such cases, the web continues as a narrow margin along the surface of the penultimate phalanx of the third and fifth toes, which may be hardly evident in desiccated material.

Boulenger's single specimen of *P. moorii* appears to fall within the range of variation of *natalensis* as here understood. The holotype is in a brittle, damaged and somewhat desiccated condition, which makes evaluation difficult. An opportunity for comparison is provided by a PEM series of eight *natalensis* in a

similar state of preservation collected by H. J. Bredo from Mambwe, some 60 km south of the *moorii* type locality (Niamkolo). In this series the broad web varies from extending well beyond the level of the distal tubercle of the outer toe to falling just short of it, and direct comparison of the *moorii* holotype with this series shows the holotype to be included in the variation: the broad web lies level with the proximal border of the fifth toe's distal tubercle. The *moorii* holotype is apparently a juvenile male with a body length of 20 mm, and shows the features typical of *natalensis* of that size.

*Distribution.* Savanna areas south of the Sahara, but not recorded in eastern coastal lowland north of Natal.

*Localities.* BOTSWANA. Four Rivers Camp (NMZB), Kasane (NMZB, TM), Khwai River (NMZB), Kwando River West Bank (NMZB, TM), 35 km Moremi South Gate (NMZB). CAPRIVI. 15 km WSW Katima Mulilo (NMZB), Matenga Falls (TM), Mpacha (TM), Muyako (TM), Western Caprivi (NMZB). ZAMBIA. Caronuweld, Mbala (BM), Chavuma (NMZB), Cheta River (NMZB), Chibutubutu (BM), Chilanga (NMZB), Chilongowelo Farm (NMZB), Chinsali (BM), Chongwe River (NMZB), Chunga (NMZB), Ikelenge (NMZB), Isombo Stream (NMZB), Kabwe (BM), Kalabo (FMNH), Kalimba (BM), Kalunulu River, Kamilonga Farm (AJL), Karubwe (NMZB), Kasama (BM, NMZL), Livingstone (AMNH, BM, NMZB, NMZL), Lower Lushwishi River (NMZB), Luचेche (BM, NMZB), Lumi River, Mbala (BM), Lusaka West (NMZB), Lutakila River, Mpika (FMNH), Makulaikwa (NMZB), Mambwe (PEM), Marshi (FMNH), Mayau River (AMNH), Mazabuka (NMZB), Mbala (BM, NMZB), Mkushi (NMZB), Monze (NMZL), Mumbwa (AMNH), Mungwi (BM), Mwekera (NMZB), Mwinilunga (AMNH), Ngambwe Falls (NMZB), Ngoma (NMZB), Niamkolo (BM), Salujinga (AMNH), Sandaula Plain (NMZB), Senje Hill (NMZB), Sesheke (NMZB, NMZL), Siantamba (NMZB), Sitwe (NMZB), Tunuw, Kasama (BM), Zambezi Camp (NMZB), Zambezi Rapids (NMZB), Zungwala (BM). MALAWI. Blantyre (AJL), Bolero (USNM), Bwaye River (USNM), Cape Maclear (NMZB), Chisenga (USNM), Chitala (BM), Dedza (USNM), Kapalassa Farm (BM), Lake Chiwondo (NMZB), Lifupa Camp (NMZB), Likabula/Chambe (NMZB), Lilongwe (NMZB), Limbe (MCZ, NMB, USNM), Limphasa Dambo (NMZB), Makoka A.R.S. (BM), Misuku Hills (NMZB), Misuku Mountains (BM, USNM), Mpata-manga Gorge (NMZB), Mzimba (USNM), Mzuzu (USNM), Nchenachena (USNM), Nkhata Bay (NMZB), Nyika Plateau (BM), Nyungwe (NMZB), Rumpi (USNM), Thyolo (NMB), Thyolo Mountain (NMZB), Vwaza Marsh (USNM), Wamkurumadzi Bridge (NMZB), Zomba (BM), Zomba Plateau (NMB, NMZB). Chiradzulu Mountain; Chitala River; Ntchisi Mountain ( Loveridge 1953a). Chiromo ( Loveridge 1953b). MOZAMBIQUE. Amatongas (BM, NMZB), Boane (NMZB), Chapala (NMZB), Chemezi (NMZB), Chinamainza (NMZB), 20 km S Erego (NMZB), Estatunane & 6 & 10 km S (NMZB), Fermerenga (NMZB), Garuso (NMZB), Gorongozo Mountain (NMZB), Inchope (NMZB), Mavita (NMZB), Metuchira (NMZB), Mhanda (NMZB), Mitucué Mountain (NMZB), Mount Meponduine (NMZB), Muda River Bridge (NMZB), 10 km SW Mungari (NMZB), Namaacha (DM, NMZB), Ponta do Calichane (NM), Ribáue Mountain

(NMZB), 10 km SSE Vila Gouveia (NMZB), Vila de Manica (NMZB), 10 km E and 24 km SE Vila de Manica (NMZB), 10 km NW Vila Pery (NMZB), 16 km SW Zobue (NMZB). ZIMBABWE. Ambi Falls (NMZB), Bangala Dam (NMZB), Banti Forest Reserve (NMZB), Beitbridge (NMZB), Bembezi (NMZB), Beverley Hills (AJL), Binga C.L. (NMZB), Birchenough Bridge (TM), Buffalo Range (NMZB), Bulawayo (NMZB), 20 km S Bulawayo (NMZB), Bunga Forest (NMZB), Calgary Farm (NMZB), 16 km SSW Chakari (AJL), Charama Plateau (NMZB), Charara Confluence, Kariba (NMZB), 30 km E Chegutu (NMZB), Chete Gorge (NMZB), Chido (NMZB), Chinhoyi and caves (NMZB), Chinyika C.L. (NMZB), Chipinda Pools (NMZB), Chipinge (NMZB), Chiredzi River (NMZB), Chiredzi North (NMZB), Chirinda Forest (NMZB), Chirisa Safari Area (NMZB), Chisumbanje (NMZB), Chivake River Bridge (NMZB), Chizirira Game Reserve (NMZB), Chomuruvati (NMZB), Cleveland Dam (NMZB), Craiglee (NMZB), Cyrene Dam (NMZB), Darwendale (NMZB), Dhlodhlo Ruins (NMZB), Dibilishaba C.L. (NMZB), Empress Mine (NMZB), Esigodini (NMZB), Fatima (NMZB), Fern Valley, Mutare (NMZB), Figtree (NMZB), Gem Farm (AJL), Gokwe (NM, TM), Gungunyana (NMZB), Gulati C.L. (NMZB), 18 km ESE Guruve (NMZB), Harare (MM, NMZB), Hazelside (NMZB), Hippo Valley (NMZB), Horseshoe Block (NMZB), Hot Springs, Chimanimani (NMZB), Hwange (NMZB), Igusi (BM) Jalopi River, Hwange (NMZB), Kadoma (AJL), Kampoti Rapids (NMZB), Kapami (NMZB), Kariba/Sonda Estuary (NMZB), Karoi (NMZB), Kapsuku Hills (NMZB), Katombora Rapids (NMZB), Kazungula Ranch (NMZB), Khami River Ranch (NMZB), Kotwa (NMZB), KweKwe (NMZB), Kyle Dam (NMZB), Lake MacIlwaine (NMZB), 20 km NW Lions Den (NMZB), Longueville Ranch (NMZB), Lower Mtarazi River (NMZB), Lukosi (NMZB), Lundi River Bridge (NM), Lupane (NMZB), Lusulu (NMZB), Main Camp, Hwange N.P. (NMZB), 27 km above Malapati Drift (NMZB), Maleme River (NMZB), Malikango (NMZB), 20 km SW Malimbasingi (NMZB), Malonga River Bridge (NMZB), Mana Pools (NMZB), Mangwe Pass (NMZB), Manyoli River, Gokwe (NMZB), Mapoff (NMZB), Mapunzuri (AJL), Mare Dam (NMZB), Marimba Ruins (AJL), Marlborough (NMZB), Masvingo (NMZB), Matendere Ruins (NMZB), Matetsi River Bridge (NMZB), Matopos (NMZB), Matusadona N.P. (NMZB), Mazoe (BM, NMZB), Melfort (NMZB), Mgwalaati Farm (AJL), Miami (NMZB), Mount Darwin (AJL), Mount Hampden (NMZB), Mount Selinda (TM), Murewa (NMZB), Musirizwi River (NMZB), Mutare (NM, NMZB), Mutemwa (NMZB), Mutoko (NM), 50 km NE & 40 km WSW Mutoko (NMZB), Mvurwe (NMZB), Mwenda Estuary/Kariba (NMZB), Ngezi Dam (NMZB), Ngorima C.L. (East) (NMZB), Nkayi (NMZB), Nyadakese Dam (NMZB), Nyamandhlovu Pan (NMZB), Nyamashato River (NMZB), 5 km W Nyampanda (NMZB), Odzi (NMZB), Pachanza (NMZB), Plumtree (NMZB), Razi Dam (NMZB), Rukute Farm (NMZB), Runde C.L. (NMZB), Rupisi Hot Springs (NMZB), Ruwa River Bridge (NMZB), Sabi/Makuni Confluence (NMZB), Sanyati River Mouth (AJL), Sengwa Gorge (NMZB), Sengwa River (NMZB), Sengwa West, Kariba (NMZB), Sote Source (NMZB), Stapleford (NMZB), Tandaai (NMZB), Togwe Wild Area (NMZB), Tsetsera (NMZB), Turk Mine (NMZB), Umfesi (NMZB), Umfuli River Bridge (AJL), van Niekerk



Ruins (NMZB), Victoria Falls (BM, MM, TM), Vumba Mountain (NMZB), Zambezi/Chewore Confluence (NMZB), Zambezi/Matetsi Confluence (NMZB), Zambezi N.P. (NMZB), Zambezi/Sabi Confluence (NMZB), Zewa Farm (NMZB), Zimbabwe Ruins (NMZB).

***Phrynobatrachus stewartae* sp. n.**

*Phrynobatrachus guttuosus*; (not Chabanaud) Poynton 1964b: 210, Stewart 1967: 96 & 1974: 827 (part).

*Types.* Holotype: a male collected in breeding condition by Dr Margaret Stewart at Rumpi, Malawi, 9 February, 1964, now housed in the National Museum, Bulawayo, Zimbabwe, UM 9493. Paratypes: two males and one female also collected by Stewart at Rumpi. One of these males (UM 9494, collected 11 February, 1964) is now housed in the British Museum, London; one male and gravid female (UM 9495, 9496, collected 13 February, 1964) are housed in the National Museum, Bulawayo.

*Diagnosis.* Male snout-vent length not more than 20 mm. Gular sac baggy with a clear posterior flap; elongated and flattened femoral glands. Tips of fingers and toes not expanded into discs. Broad web extending  $\frac{1}{3}$  to  $\frac{2}{3}$  of way between subarticular tubercles of third toe; extending well beyond proximal tubercle of fourth toe on inner side, level with or just passing it on outer side; approaching to just reaching distal tubercle of fifth toe. Margin of web reaching distal tubercle of third toe and middle tubercle of fourth, continuing as a fringe. Tarsal tubercle a transverse fold with a somewhat compressed spur.

*Description.* Upper and lower jaws barred, no light subtympenic streak. Gular region of male greyish, gular region of female speckled. Posterior face of thigh with faint longitudinal banding; the femoral gland of the male is described by Stewart (1967) as 'conspicuous, yellow'. Dorsal skin glands mainly rounded, none arranged in longitudinal rows. Dimensions of holotype: snout to urostyle tip 18,3 mm, width head 6,6 mm, internarial distance 2,4 mm, length tibia 8,8 mm.

*Remarks.* Poynton (1964b) referred one of Stewart's series of *Phrynobatrachus* from Rumpi to *guttuosus* Chabanaud 'with a certain amount of doubt' because 'the fingers and toes of the Rumpi series are without clear discs, and the webbing in most specimens is more extensive than is typical of *guttuosus*'. This conception of *guttuosus* was based on that of Schmidt & Inger (1959), which as discussed under *rungwensis* Loveridge (see p. 164), now seems mistaken; Shaba material, including Schmidt & Inger's material, appears to be *rungwensis*. The differences which were noted by Poynton (1964b) between the Rumpi series and *rungwensis* (as *guttuosus*) are, according to present assessment, too great to admit conspecificity.

Stewart (1967) noted her small Rumpi species to be in many respects intermediate between *natalensis* and *mababiensis*. Confusion of *stewartae* with these two species is easy. Mature males of *stewartae* and *natalensis* can be separated on size, but dissection seems the only way of distinguishing a juvenile *natalensis* with reduced webbing from a female *stewartae*. The webbing of *stewartae* is more extensive than even the extreme development in *mababiensis*. It may also prove

difficult to separate *stewartae* from *rungwensis* in desiccated material, since the possession of digital discs in *rungwensis* is a more notable point of difference between the two species.

*Distribution.* So far known only from Malaŵi.

*Locality.* MALAŴI. Rumpi (BM, NMZB).

*Phrynobatrachus rungwensis* (Loveridge)

*Arthroleptis rungwensis* Loveridge 1932: 386. 'just below the Moravian Mission at Iloilo at the base of Rungwe Mountain, southwestern Tanganyika Territory', ie. Tanzania. Holotype in the Museum of Comparative Zoology, Harvard.

*Phrynobatrachus gutturosus*; (not Chabanaud) Schmidt & Inger 1959: 151.

*Diagnosis.* Male snout-vent length not more than 23 mm. Gular sac bounded posteriorly by a marked fold; elongate and flattened femoral glands present. Tips of middle toes expanded into small discs with usually discernible circummarginal grooves, tips of fingers slightly dilated. Broad web extending  $\frac{1}{3}$  to  $\frac{2}{3}$  of way between subarticular tubercles of third toe, passing proximal tubercle of fourth toe on inner side, reaching to just passing it on outer. Margin of web reaching distal tubercle of third toe and middle tubercle of fourth, usually continuing as a fringe. Tarsal tubercle conical, no strong development of a transverse fold.

*Description.* Upper and lower jaws with well-marked, regularly spaced light and dark barring, no light subtympenic band. Gular region of male greyish to speckled, gular region of female speckled; pectoral region of both sexes sparsely speckled. Posterior face of thigh with a light band bordered below with an unbroken or almost unbroken dark border. Dorsal skin glands mainly rounded, none arranged in longitudinal rows.

*Remarks.* Identification of the Nkhata Bay, Lake Malaŵi, specimens is based on examination of the holotype of *rungwensis* and material from Lukafu, Zaïre (MCZ 21694–21700), received by the MCZ 'from the Congo Museum as *gutturosus* Chabanaud' (Loveridge 1957) and re-identified by Loveridge as *rungwensis*. The type description states, 'Tips of fingers and toes tapering, not dilated', whereas the Lukafu series shows expanded ends to the toes with circummarginal grooves. However, the toes of the holotype (and only type specimen) are desiccated, and there are indications that in life they were expanded as in the Lukafu series: evidently Loveridge believed this to be so when he assigned the Lukafu specimens to *rungwensis*.

That the Lukafu series is not *gutturosus* is confirmed by comparing the material with BM syntypes of *gutturosus*, which have less extensive webbing. The illustration of the West African *gutturosus* Chabanaud by Guibé & Lamotte (1963, fig. 14) gives an accurate portrayal of the webbing. We are particularly grateful to Miss A. G. C. Grandison for initially suggesting the name *rungwensis* for the Nkhata Bay specimens, and for independently comparing this material with the *gutturosus* syntypes and the *rungwensis* type and Lukafu series.

Material from the Upemba National Park identified by Schmidt & Inger as *gutturosus* appears to be conspecific with the Lukafu series. Evidently all Shaba records of *gutturosus* should be referred to *rungwensis*.

This species resembles *stewartae* sp. n. particularly closely, especially when specimens are desiccated and do not show the digital discs clearly. The species could also be confused with short-webbed specimens of *natalensis*.

*Habitat.* No data available.

*Distribution.* Shaba, southwestern Tanzania and northern Malawi.

*Locality.* MALAWI. Nkhata Bay (NMZB).

### *Phrynobatrachus mababiensis* FitzSimons

*Phrynobatrachus mababiensis* FitzSimons 1932: 40. Tsotsorogo Pan, Mababe Flats. Holotype in the Transvaal Museum, Pretoria. Simbotwe & Patterson 1983: 22.

*Phrynobatrachus chitilaensis* Hoffman 1944: 177. 'Chitila', ie. Chitala River, Malawi. Holotype in the National Museum, Bloemfontein.

*Phrynobatrachus ukingensis mababiensis* FitzSimons, Loveridge 1953a: 381 (part), FitzSimons 1958: 231, Poynton 1964a: 141 (part) & 1964b: 211 (part) & 1966: 23 & 1982: 17, Stewart & Wilson 1966: 301 (part), Stewart 1967: 98 & 1974 (part), Broadley 1971: 117, Stevens 1974: 8 (?part).

*Phrynobatrachus cryptotis*; Inger (? not Schmidt & Inger, part) 1959: 521.

*Diagnosis.* Male snout-vent length not more than 19 mm (usually not exceeding about 16 mm). Gular sac baggy with a well-marked transverse posterior fold; flattened femoral gland present. Tips of fingers and toes sometimes slightly expanded, but without clear discs. Broad web incised usually to level of proximal subarticular tubercle of third toe, but occasionally incised not as far as, or even further than, this level; usually incised below proximal tubercle of fourth toe but sometimes incised only to level of this tubercle on inner side (see Remarks); usually incised to about level of proximal tubercle of fifth toe. Margin of web usually falling just to, to well short of, distal tubercle of third toe except for a fringe, usually falling short of middle tubercle of fourth toe. Tarsal tubercle a prominent cornification of a transverse, flap-like continuation of the tarsal fold.

*Description.* Upper and lower jaw with well-marked, fairly regularly spaced light and dark barring, the barring on upper and lower jaw typically confluent. Gular region in males greyish, in females with a scattering of melanophores. Chest and abdomen usually immaculate, but occasionally (and more frequently in the west) with a scattering of pigment or freckled. Posterior face of thigh tending to have a broad light band with somewhat irregular borders extending from knee to beside vent. Dorsal skin glands tending to be raised to give a warty appearance; none arranged to form longitudinal folds.

*Habitat.* Although not avoiding woodland or even marginal forest, this species is particularly abundant and widespread in drier savanna. It occurs around the borders of pans, vleis and streams. Individuals effectively conceal themselves in vegetation, usually grass, which allows them to call even during the day. A wide variety of dorsal colour patterns appears to be a part of the cryptic strategy as Stewart has pointed out (Stewart 1974, Milstead, Rand & Stewart 1974).

*Remarks.* Small-sized *Phrynobatrachus* material has been a source of long-standing confusion. Quite apart from difficulties in being able to separate even well-preserved material, the types of three of the most commonly considered species, namely *minutus*, *parvulus* and *mababiensis*, are poorly preserved or immature. Opinions expressed in the literature vary from regarding all these three types as representing separate species to their being conspecific.

Comparison of the holotype and three paratypes of *mababiensis* with the single type of *minutus* from Somaliland shows very few clear differences. Body length of both holotypes is approximately the same (*mababiensis* 14,5 mm, *minutus* 15,5 mm), but comparison is made difficult by the brittle and somewhat desiccated state of the *mababiensis* material and the very damaged feet of the *minutus* type. The two types hardly differ in tibia length (*mababiensis* 48,9 % body length, *minutus* 46,5 %), but the relatively shorter tibia of *minutus* may be accompanied by a shorter foot: a single broken third toe is the only complete digit in the *minutus* type, but joint-by-joint comparison with the *mababiensis* type shows the *minutus* joints to be shorter. Webbing in the *mababiensis* type appears to be slightly less extensive (if allowance is made for the desiccated condition): the broad web is incised to the level of the distal edge of the basal tubercle of the third toe and the margin of web does not appear to extend beyond the distal tubercle of that toe; in the *minutus* specimen the broad web extends well beyond the basal tubercle of the third toe, the level being half way along the basal tubercle of the fourth toe, and a very definite margin of web passes the distal tubercle of the third toe, apparently for the full length of the next phalanx. A margin also passes the middle tubercle of the fourth toe. The webbing of the *minutus* type does not, however, fall conspicuously outside the total range of variation in southern material here assigned to *mababiensis*.

The only complete toe of the *minutus* type (third toe) shows a clear, rounded expansion to the tip, equal in width to the distal tubercle of the toe, and shows a very faint circummarginal groove. The *mababiensis* type material is too shrivelled to show the condition of the toe tips, but the discs indicated in the *minutus* type are not developed in southern material referable to *mababiensis*.

The tarsal tubercles of the two species are very similar, being a flattened, flap-like fold of the tarsal ridge. This condition differs from the conical shape described under *parvulus* and *ukingensis*.

Markings of the types are difficult to discern because of fading, but appear to be similar. The *mababiensis* type shows 'typical' barring of the upper and lower jaws, and no eye-to-arm light band (the latter taken to be characteristic of *parvulus* and *ukingensis*). There is some indication of barring on the upper jaw of the *minutus* type, and while there are some light patches between the eye and arm insertion, there is no continuous light band as in 'typical' *parvulus* and *ukingensis*.

Comparison of gular sacs is not possible. Although the *minutus* type appears to be a full-grown male, as shown by dissection and the presence of femoral glands, it lacks gular folding and darkening, evidently being out of breeding condition. The *mababiensis* type has darkened gular skin, with longitudinal transverse folding.

A notable difference between the two types lies in the distance between eye and nostril. In *mababiensis* this distance is 84 % of the internarial distance and 89 % of the interorbital distance, whereas in *minutus* the eye-nostril distance is 68 % of both internarial and interorbital distance. Material from southern Sudan and Ethiopia in the British Museum lacks the *minutus* margin of web which reaches the second-to-last phalanx of the toes, and the broad web tends to fall between the levels of the *minutus* and *mababiensis* types. The toe tips are not expanded in the manner indicated in the *minutus* type. Eye-nostril/internarial distance ratios fall between the values of the *minutus* and *mababiensis* types, but are generally closer

to *mababiensis*. It seems not unreasonable to regard this material as being conspecific with *mababiensis*, but unsound to regard the *mababiensis* and *minutus* types as being conspecific. The available material, undoubtedly inadequate, suggests that the *minutus* type represents a species showing a moister habitat preference and a restricted geographical range. Clearly, more material from the area of the *minutus* type (Durru, western Somaliland, 07°15' N : 41°10' E) is needed to test this conjecture.

As indicated in the foregoing discussion, the extent of webbing in *mababiensis* shows appreciable variation. Several series from western Zambia to Mozambique show constancy in the failure of the broad web to pass the level of the proximal tubercle of the third toe, as in the type series. Yet in other series (eg. NMZB 25647–51 from Chiredzi), webbing can vary from showing the 'typical' reduced condition to passing the level of the proximal tubercle of the third toe, and occasionally reaching the level of the proximal tubercle of the fourth toe, comparable with the condition of the *minutus* type. The diagnosis given here of *mababiensis* sets the extreme of broad web development somewhere along the level of the proximal tubercle of the fourth toe on its inner side, but in fact, in a few NMZB specimens from scattered localities in Zimbabwe, it is equivocal whether the edge of web does or does not actually pass this level on both feet, although it may clearly do so on one foot. This condition approaches the webbing of *stewartae* sp. n., although in this species the web passes the tubercle on the outer as well as on the inner side.

It may be noted that paratype series of *cryptotis* Schmidt & Inger show the extent of broad web also reaching somewhere along the level of the proximal tubercle of the third toe although, as noted by Schmidt & Inger, it occasionally passes beyond this tubercle. It may even reach the level of the tubercle of the fourth toe in Upemban material. In webbing, as in other features examined, it seems impossible to separate either Upemban *cryptotis* or Zambian FNHM material identified by Inger as *cryptotis* from southern material which is customarily assigned to *mababiensis*. Schmidt & Inger did not consider *mababiensis* in their description of *cryptotis*.

As is discussed under *parvulus* Boulenger, it is difficult—and sometimes seemingly impossible—to separate *parvulus* on external features from *mababiensis*. Loveridge did not explicitly distinguish between *mababiensis* and *parvulus* in his Malaŵi paper (1953a), yet in discussing his Limbe series he observed, 'It is possible that *minutus* ♀♀ are included.' The five females, with broad web varying from the level of the proximal tubercle of the third toe to just reaching the tubercle of the fourth, correspond exactly with our conception of *mababiensis*. The five males in the series consist of one *mababiensis* and four *parvulus*—'the black-throated *mababiensis*' of Loveridge (1953a: 382). The custom started by Loveridge (1953a) of treating *mababiensis* as a subspecies of *ukingensis* arises from his regarding *mababiensis* and *parvulus* as a single species. As noted under *ukingensis*, close relationship evidently exists between *ukingensis* and *parvulus*, but not between *ukingensis* and *mababiensis*.

Large series collected on the Nyika Plateau by Stewart in Malaŵi and Wilson in Zambia are particularly difficult to assign either to *mababiensis* or *parvulus* (Poynton 1982). An apparently unbroken range of variation, involving an

independent assortment of diagnostic characters used here, is shown from typical *mababiensis* (a small minority) to typical *parvulus* (which are much more common). Further, all unassignable males dissected have both dorsal and ventral lineae masculinae, allowing no separation on this feature used by Schmidt & Inger in distinguishing *parvulus* from *cryptotis* (*mababiensis*). As Nyikan collections made up a large part of dwarf puddle frog material of both Stewart and Wilson, it is understandable that these authors and Poynton (1964b) followed Loveridge in not distinguishing between *mababiensis* and *parvulus*. Limited material from the Harare area suggests a similar range of variation from *mababiensis* to *parvulus* (the latter being more common). Research should be taken up at that centre.

However, in most localities where the two species have been collected together, separation can be made fairly readily. Ecological differences are indicated by the preference of *parvulus* for moister areas, as discussed under that species.

Much work, preferably in the field, is needed to determine whether this species actually does extend to Ethiopia and Sudan, as is suggested in the discussion above. If this is the case, the possibility of a senior synonym should be borne in mind. While some of Loveridge's more northern material which he assigned to *minutus* is apparently *mababiensis*, notably a large series from Dar es Salaam (MCZ 15205–25/101164–72), other important series, such as from Kigogo and Dabaga (Loveridge 1933), are neither *minutus* nor *mababiensis*. The Kigogo and Dabaga '*minutus*' seem to resemble *anotis* Schmidt & Inger most closely, and this species should be looked for in northern uplands of the Zambesiaca area.

*Distribution.* In southern Africa the species appears to span the continent as far south as the Limpopo Basin (desert apart), and to continue down the eastern lowlands to the Transkei. Taxonomic uncertainties do not permit a definite determination of its northern range, but it may extend as far as Ethiopia and Sudan.

*Localities.* BOTSWANA. Kasane (TM), Mpacha (TM), Tsotsorogo Pan (BM, TM), Xaxaba (NMZB). CAPRIVI. 10 km S Kongola Ferry, Kwando River (TM), Lake Liambezi (NMZB). ZAMBIA. Chilongowelo (NMZB), Chipangali (NMZB), Chipata (NMZB), Chunga (NMZB), Isoka (NMZL), Kabwe (BM), Kafue (NM), Kalabo (AMNH, NMZB), border E of Kalabo (NMZB), Kalomo (AMNH), Kamilonga Farm (AJL), Kasama (NMZL), Livingstone (AMNH, NMZL), Luangwa (NMZL), Lufupa River (NMZB), Lunsemfwa River (NMZB), Marshi (FMNH), Mfuwe (NMZB), Mkanda (NMZB), Monze (NMZL), Niamkolo (MCZ), Salujinga (AMNH), Sandaula Plain (NMZB), Sasare (NMZB), Sayiri Court (NMZB), Sesheke (NMZL), Sitwe (NMZB), Victoria Falls (MCZ). MALAWI. Blantyre (USNM), Chisenga (USNM), Chitala River (MCZ, NMB), Chitipa (USNM), Dedza (MCZ, USNM), Kambwe (USNM), Lilongwe (NMZB), Limbe (MCZ), Limphasa Dambo (NMZB), Liwonde (NMZB), Mangoche (NMZB), Mbamba Bay (USNM), Mtimbuka (MCZ), Nyika Plateau (NMZB, USNM), Vwaza Marsh (NMZB). MOZAMBIQUE. Alves de Lima (NMZB), Amatongas (NMZB), 13 & 16 km NE Beira (NMZB), Boane (NMZB, TM), 8 km N Canda (NMZB), Chapala (NMZB), Chitengo (NMZB), Comacha (NMZB), Dondo & 8 km NW (NMZB), 6 km S Estatuane (NMZB), Fermerenga (NMZB),

Garuso (NMZB), Gondola–Gorongosa Pontoon (NMZB), Inhaca Island (NMZB), Inhaminga (NMZB), Kasumbadedza (BM, MCZ), Lua River Bridge (NMZB), Macuti (NMZB), Magasso (NMZB), Manga (NMZB), Metambanhe (NMZB), Metuchira (NMZB), Mhanda (NMZB), Mitucué Mountain (NMZB), 15 km S Muanza (NMZB), Namaacha (NMZB), Nova Sofala (NMZB), Ribáuè Mountain (NMZB), Savane (NMZB), 72 km ENE Tete (NMZB), Vila de Manica (NMZB), 24 km SE Vila de Manica (NMZB), 15 km SE Vila Franco do Save (NMZB), Viola (NMZB), Xiluvo (NMZB), Zinave (NMZB). ZIMBABWE. Atlantica E.R.S. (AJL), Birchenough Bridge (NMZB), Buffalo Range (NMZB), Bundi Valley (NMZB), Burma (NMZB), Charara Confluence (NMZB), Chewore Game Reserve (NMZB), Chibakwe River Bridge (NMZB), Chibvumani Ruins (NMZB), Chinyika Reserve (NMZB), Chipinda Pools (NMZB), Chiredzi (NMZB), Chitza (NMZB), Chiwaka River (NMZB), Chizarira N.P. (NMZB), Concession (NMZB), Dichwe Forest (NMZB), Fern Valley (NM, NMZB), Figtree (NMZB), Foliot Farm (NMZB), Gulati C.L. (NMZB), 6 km NE Gweru (AJL), Hazelside (NMZB), Harare (AJL), Hippo Valley (NMZB), Hunyani River (NMZB), Kapsuku Hills (NMZB), Kariba (NMZB), Karoi (NMZB), Kasuma Pan (NMZB), Kazungula (DM, NMZB), KweKwe (NMZB), Limpopo River 22°08' : 29°30' (NMZB), Lundi River Bridge (NM), Mabalauta (NMZB), Macheke (NMZB), Madingazula Dam (NMZB), Main Camp, Hwange N.P. (NMZB), Majinji Pan (NMZB), 19 km SW Malimbasingi (NMZB), Malonga River Bridge (NMZB), Mambwe Pan (NMZB), Mana Pools (NMZB), Mapoff (NMZB), Mare Dam (AJL), Marhumbini (NMZB), Matusadona N.P. (Nyamini River) (NMZB), Mhangura (NMZB), Mutare (NMZB), Mutoko (NM), 40 km WSW Mutoko (NMZB), 52 km NE Mutoko (NMZB), Ngezi Rec. Park (NMZB), Norton (AJL), Nyamashato River (NMZB), Nyamaziwa (TM), Pokwe Camp (NMZB), Razi Dam (NMZB), Rukute Farm (NMZB), Rupisi Hot Springs (NMZB), Sable Park (NMZB), Saruwe River (AJL), Sengwa River (NMZB), Shapi Pan (NMZB), Shoka Farm (NMZB), Soti Source (NMZB), Tsungwezi (NMZB), Tynwald (NMZB), Victoria Falls (MCZ, NMZB), West Sebungwe (NMZB), World's View, Matopos N.P. (NMZB), Zambezi Camp (NMZB), Zambezi N.P. (NMZB), Zambezi River opp. Feira (NMZB), Zambezi River, 20 km NNE Kariba (AJL), Zimbabwe Ruins Hotel (NMZB).

*Phrynobatrachus parvulus* (Boulenger)

*Arthroleptis parvulus* Boulenger 1905: 109, pl. 4, fig. 3. Bange Ngola, northeastern Loanda, Angola. Syntypes in the British Museum (N.H.), London.

*Phrynobatrachus ukingensis nyikae* Loveridge 1953a: 380. Nyika Plateau, Malawi. Holotype in the Museum of Comparative Zoology, Harvard.

*Phrynobatrachus ukingensis mababiensis*; (not FitzSimons) Loveridge 1953a: 381 (part), Poynton 1964a: 141 (part) & 1964b: 211 (part), Stewart & Wilson 1966: 301 (part), Stewart 1967: 98 (part) & 1974 (part).

*Phrynobatrachus parvulus* (Boulenger), Poynton 1982: 17.

**Diagnosis.** Male snout-vent length rarely exceeding 16 mm. Gular sac baggy with a well-marked transverse posterior fold; flattened femoral gland present. Tips of fingers and toes without discs. Broad web incised usually to level of proximal subarticular tubercle of third toe; usually incised below level of proximal tubercle of fourth toe but sometimes incised only to level of this tubercle on inner side;

usually incised to about level of proximal tubercle of fifth toe. Clear margin of web reaching distal tubercle of third toe and continuing as a fringe, usually reaching middle tubercle of fourth toe. Tarsal tubercle rounded at base, papillate with a conical profile; no, to virtually no, development of a tarsal ridge with a transverse flap.

*Description.* Upper and lower jaw continuously dark to showing faint barring especially on upper jaw. A usually continuous light subtympanic band extending from lower eyelid to base of arm, typically bordered above and (usually less completely) below by an irregular dark band. The light band may be highlighted by silvery spots or patches. Gular region of males greyish to black, venter with scattered to heavily clumped pigment; gular region of females freckled, as is entire venter except for posterior extreme. Posterior face of thigh with a narrow to broad light band extending from knee to beside vent. Dorsal skin glands tending to be inconspicuous; none arranged to form longitudinal folds.

*Habitat.* Moist savanna, penetrating evergreen forest in association with *Arthroleptis xenodactyloides*. It occurs at the edge of ponds which are choked with vegetation.

*Remarks.* Although Loveridge recognised a species which he called *parvulus* in his earlier work (1933), later (1953a) he assigned the material to *mababiensis*, and indeed suggested that *parvulus* 'is a western relative of *mababiensis* or a synonym of *minutus*' (p. 382). Schmidt & Inger (1959), however, assigned Upemba material, which seems to be conspecific with Loveridge's *parvulus*, to *parvulus* Boulenger, and we follow this procedure in the interests of nomenclatural stability even though the immature state of the three syntypes of *parvulus* leaves some doubt as to the correctness of this assignation. This species is not easy to distinguish on external morphology from *mababiensis*, but a suite of characters involving labial and subtympanic markings combined with the shape of the tarsal tubercle (see respective diagnoses) usually serves to separate material into *parvulus* and *mababiensis* as here understood. The degree of webbing shows the same complex ranges of variation in *parvulus* as described in *mababiensis*, and cannot be used to separate the two species.

There is a tendency for *parvulus* to be associated more with upland and forest conditions than is *mababiensis*. All Loveridge's material of *parvulus* (1933) was taken from montane situations (and so tending to be forested), which accords with the distribution of this species in Malawi, Zambia and Zimbabwe. It is, however, widely sympatric with *mababiensis* in all but lowland savanna, and it appears to hybridize with this species at some localities (Poynton 1982; see also under *mababiensis*).

*P. ukingensis nyikae* Loveridge was placed in the synonymy of '*u. mababiensis*' of Loveridge by Poynton (1964b) and Stewart (1967). As noted in the discussion of *mababiensis*, the latter authors followed Loveridge (1953a) in treating *parvulus* and *mababiensis* as a single species. Re-examination of Loveridge's *nyikae* type material shows it to fall within the range of *parvulus* as here understood. Tibial length tends to be much reduced in material from the Nyika Plateau, as Loveridge (1953a) emphasised when using this feature to diagnose *nyikae* (cf. *Arthroleptis*



*xenochirus* Boulenger from the Nyika, Poynton & Broadley 1985). Loveridge also emphasised 'the much darker coloring' of his Nyikan material. Large series collected by Stewart and Wilson on other parts of the Nyika Plateau do not confirm a correlation between tibial length reduction and darker coloration; in fact the specimen with the shortest tibiae measured in Wilson's collection (39,3 % body length) is an adult male with a grey (not black) gular area and virtually immaculate abdomen. It could be suggested that if Loveridge had consistently separated *parvulus* (his 'black-throated *mababiensis*', 1953a: 382) from *mababiensis* of FitzSimons, he would have found coloration not to be a reliable means of separating his Nyikan series (which contains no *mababiensis*) from other *parvulus*.

*Distribution.* More upland areas of Angola, Botswana, Zambia, Zimbabwe, Malawi, Tanzania and Shaba (Zaire). Northern part of range not determined due to taxonomic uncertainty.

*Localities.* BOTSWANA. Khwai River (NMZB). ZAMBIA. Chilongowelo (NMZB), Chinsali (BM), Kachalola (AMNH), Kanjanjesi (NMZB), Kasempa (AMNH), Mambwe (PEM), Mbala (PEM), Mpulungu (PEM), Mumbwa (AMNH), 30 km N Mwinilunga (AMNH), Ngambwe Falls (NMZB), Nyika Plateau (NMZB). MALAWI. Chelinda Depot, Nyika Plateau (USNM), Chikangawa (USNM), Cholo Mountain (NMZB), Likabula River (MCZ), Limbe (MCZ), Livingstonia (USNM), Lujeri (NMZB), Nkhata Bay (NMZB), Nyika Plateau (MCZ, NMZB), Vipya Plateau (USNM). ZIMBABWE. Albany Farm (NMZB), Atlantica E.R.S. (AJL), Banti Forest Reserve (NMZB), Bromley (NMZB), Chinyika C.L. (NMZB), Chipinga (NMZB), Cloudlands (NMZB), Darwendale (NMZB), Dichwe Forest (NMZB), Harare (AJL, NMZB), Haroni Forest (NMZB), Honde Valley (NMZB), Karoi (NMZB), Leopard Rock (AJL, NMZB), London Farm (NMZB), Lower Mtarazi River (NMZB), Macheke (NMZB), Mapopo River (NMZB), Marondera (NMZB), Mare Dam (NMZB), Mutare (NMZB), Mvurwi (NMZB), Ngorima Reserve (E) (NMZB), 11 km SW Norton (AJL), Nyamashato River (NMZB), 5 km N Prince Edward Dam (AJL), Razi Dam (NMZB), Selborne (NMZB), Vumba National Park (NMZB).

### *Phrynobatrachus ukingensis* (Loveridge)

*Arthroleptis ukingensis* Loveridge 1932: 385. Madehani, Ukinga Mountains, Tanzania. Holotype in the Museum of Comparative Zoology, Harvard.

*Phrynobatrachus ukingensis ukingensis* (Loveridge), Loveridge 1953a: 379, Poynton 1964b: 211, Stewart 1967: 98.

*Diagnosis.* Male snout-vent length not more than 17 mm. Gular sac baggy with a tendency to form a posterior fold; flattened femoral glands present. Tips of fingers and toes slightly expanded into discs, with weak or no circummarginal grooves on toes. Broad web usually incised below level of proximal tubercle of fourth toe, but sometimes incised only to level of this tubercle on inner side; usually incised to about level of proximal tubercle of fifth toe. Margin of web falling short of distal tubercle of third toe except for a fringe, falling just to well short of middle tubercle of fourth toe. Tarsal tubercle a weakly developed, more or less conical papilla; little to no development of a tarsal ridge with transverse flap.

*Description.* Upper and lower jaw continuously dark to showing faint or rarely well-marked barring. A continuous light subtympenic band extending from lower eyelid to base of arm, typically bordered above and (usually less completely) below by an irregular dark band. Gular region of male black, venter with freckling at least in the anterior region; gular region of females freckled, as is entire venter except usually the posterior extreme. Posterior face of thigh with an indistinct light band extending along length. Dorsal skin glands weakly developed, elongated into ridges bordering a light dorsal band if this is present.

*Habitat.* Reported from marshy areas in the open or at the edge of forest by Loveridge (1953a) and Stewart (1967).

*Remarks.* In all the features that distinguish *mababiensis* and *minutus* from *parvulus*, *ukingensis* resembles *parvulus*. The practice started by Loveridge (1953a) of placing *mababiensis* as a subspecies of *ukingensis* therefore seems ill conceived. The difference between *ukingensis* and *parvulus* seems to lie only in the presence of toe discs in the former, a feature whose taxonomic significance is questioned by Stewart (1967) on the grounds that 'digital expansions' could be 'part of the normal variation' of *parvulus*-*mababiensis*. Variation in shape of digital endings does indeed include a degree of flattening which borders on what may be called 'discs', but the *ukingensis* condition appears to fall outside this range. For the moment, therefore, it seems best to list the taxa as full species. However, as Stewart notes, the situation requires more investigation at possible 'points of contact'.

The single *Nchenachena* specimen (USNM 52898) referred to *ukingensis* by Stewart (1967) has definite digital discs with faintly discernible circummarginal grooves at least on the fourth toes. A male and female collected by Jocque at Nkwari (RGMAC 79-28-B-25, 26) also have expanded tips. A BM specimen taken from the side of the Makoka A.R.S. Lake (21 km SW of Zomba) has definite circummarginal grooves on the digital discs.

*Distribution.* Malaŵi and southern Tanzania.

*Localities.* MALAŴI. Makoka A.R.S. (BM), Matipa Forest, Misuku Mountains (BM, MCZ, USNM), *Nchenachena* (USNM), Nkwari (RG).

### Genus *Nothophryne* Poynton

*Nothophryne* Poynton 1963: 324. Type by original designation: *N. broadleyi* Poynton. Dubois 1981: 253.

Mongrel Frog. Vomerine teeth absent. Omosternum ossified and entire posteriorly, procoracoid bars not ossified, straight. Tongue with a median papilla. Toes without webbing. Metatarsals bound.

Apparently restricted to some mountainous areas north of the lower Zambezi. Eggs laid in wet moss, tadpoles dispersing over wet rock.

A specimen collected by Stevens (AS 503) at the Muluzi River, Mulanje Mountain (type locality of *Ptychadena broadleyi* Stevens), suggests the presence of another species of *Nothophryne* at the base of Mulanje. It is more slender, with narrower head and longer tibiae, giving a head width/tibia length ratio of 69,8 %; in *broadleyi* the value is greater than 80 %. Its ventral surface is practically immaculate. While *broadleyi* recalls *Cacosternum capense* Hewitt in its general

appearance, the slenderness of the Muluzi River specimen makes it more *Phrynobatrachus*-like.

Further collecting in the area is clearly needed.

### *Nothophryne broadleyi* Poynton

*Nothophryne broadleyi* Poynton 1963: 326, pl. 4. Mount Mulanje, Malaŵi. Holotype in the National Museum, Bulawayo. Poynton 1964b: 212 & 1966: 23, Stewart 1967: 102, Stevens 1974: 8.

**Description.** Maximum size of males 20 mm, of females, 27,5 mm. Body somewhat flattened, recalling the general appearance of *Cacosternum capense*. A light interocular bar usually present, bordered behind by a dark bar. A pair of oblique dark bars behind the scapular region forms the anterior border of a light patch usually present in the middle of the back. A light middorsal line from snout to vent present in specimens from all large series, but more common in some series than in others. Legs strongly cross-barred. Ventral surface with few to many irregularly shaped dark specks or blotches, not unlike *Cacosternum*.

Tips of fingers barely, to noticeably, expanded into discs—a feature not reported in the original description.

Males distinguishable by a more extensive blotching of the throat, or the throats may become more or less uniformly darkened. There is no loose gular skin pouch. Entrance to the vocal sac is through a large slit near each angle of the jaw. The call is a weak chirp. A conspicuous nuptial pad is developed as a swelling along the metacarpal of the first finger.

**Habitat.** This form breeds in vast numbers on the extensive rock outcrops on Mulanje Mountain, and occurs from foot to summit. Eggs are laid in wet moss at the edge of rivulets running over the rock, and tadpoles disperse by migration across wet rock.

**Remarks.** When describing the genus and species, Poynton (1963) reported that 'the ovaries contain relatively small eggs' which are darkly pigmented. These observations were based on the holotype, 'a young but gravid female'. Material collected subsequently shows that eggs in the ovary in fact attain a diameter of about 1,5 mm. Only about 30 eggs in each ovary attain this size, however, the remainder not undergoing development. The developed eggs retain dark pigment in one hemisphere. The testes are slightly morulated and unpigmented.

**Distribution.** Possibly widespread on mountains to the southeast of Lake Malaŵi.

**Localities.** MALAŴI. Mulanje Mountain: Dzole, Likabula–Chambe, Lujeri–Madzeka, Madzeka Basin, Sombani Basin, Tuchila Basin (NMZB). MOZAMBIQUE. Ribáuè Mountain (NMZB).

### Genus *Cacosternum* Boulenger

*Cacosternum* Boulenger 1887: 51. Type by monotypy: *C. nanum* Boulenger. Dubois 1981: 252.

Vomerine teeth absent. Omosternum a small cartilaginous peg to absent, procoracoid bar incomplete or very tenuous. Toes without webbing. All metatarsals bound in a fleshy sole. Belly with discrete dark spots.

Essentially a non-tropical genus, centered in South Africa, with relict populations in the East African highlands and in Shaba, Zaïre. No specialised breeding habits. Eggs laid in shallow, open grassy dambos or small streams.

*Cacosternum boettgeri* (Boulenger)

*Arthroleptis boettgeri* Boulenger 1882: 118, pl. 11, fig. 6. Kaffraria, ie. eastern Cape Province. Holotype in the British Museum (N.H.) London.

*Cacosternum boettgeri* (Boulenger). Boulenger 1910: 533, FitzSimons 1935: 393, Poynton 1964a: 146, Broadley 1971: 118.

**Diagnosis.** Length of foot less than half body length, tibia length not more than 44 % body length. Belly white with black to grey spots, usually rounded; gular region immaculate to mottled with light grey.

**Description.** Size not known to exceed 23 mm. Body giving flattened appearance; inner and outer metatarsal tubercles and subarticular tubercles present, conical to spur-like. Dorsal coloration green to brownish, with or without dark or light longitudinal stripes.

**Habitat.** Typically found in open grassy pans or flooded grassland, often far from watercourses.

**Distribution.** All of South Africa except Namaqualand and the Mozambique Plain. Eastern Botswana, Zimbabwean plateau (but not eastern highlands), southern Zambia. Large series in the British Museum from Ethiopia seem inseparable from South African material of *boettgeri*, confirming identifications of the hitherto limited amount of upland East African material as *boettgeri*. Possibly occurring in Shaba (Zaïre) as *leleupi* Laurent (1950).

**Localities.** BOTSWANA. 64 km NW Francistown (NMZB), between Kokong and Lehutitung (? Lehututu) (BM), Lobatsi (MM), Metsemothaba River (TM), Tonota (NMZB), Vloorskop (NMZB). CAPRIVI. Western Caprivi (NMZB). ZAMBIA. Bilibili Hot Springs (NMZB), Livingstone (SAM). MOZAMBIQUE. Bela Vista (DM). ZIMBABWE. Bulawayo (NMZB), 19 km S Bulawayo (NMZB), 26 km NW Bulawayo (NMZB), Bembezi (NMZB), Gwanda (NMZB), Gwebi (NMZB), Gweru (AM), Harare (AM, NMZB), 16 km W Harare (NMZB), Heany (NMZB), Inyati T.T.L. (NMZB), Kadoma (AJL), 4 km NE Kadoma (AJL), Kazuma Pan, Hwange (NMZB), KweKwe (AJL, NMZB), Masvingo (NMZB), Matopos (NMZB), Matopos National Park (NMZB), Mount Hampden (NMZB), Mvuma (NM), Rhodes Estate Prep. School, Matopos (AJL), Rukute Farm (NM), Sengwa Gorge (NMZB), Teaklands (NMZB), Warren Hills (AJL), Zimbabwe Ruins (NMZB).

*Cacosternum nanum nanum* Boulenger

*Cacosternum nanum* Boulenger 1887: 52. Kaffraria, ie. eastern Cape Province. Holotype in the British Museum (N.H.), London.

*Cacosternum n. nanum* Boulenger. Poynton 1964a: 148.

**Diagnosis.** Length of foot equal to, to slightly more than half body length, tibia length not less than 44 % body length. Belly mottled with irregular grey patches; gular region heavily mottled with grey, sometimes to the extent of leaving only a whitish network on grey.

*Description.* Size not known to exceed 25 mm. Body giving a somewhat flattened appearance; inner and outer metatarsal tubercles and subarticular tubercles well developed, spur-like. Dorsal coloration brown to olive, with darker, usually symmetrically paired flecks and patches.

*Habitat.* Typically found in the vicinity of grassy or overgrown streams, often calling in flooded grassland beside streams.

*Distribution.* Southern and eastern part of South Africa, excluding the Mozambique Plain; southwestern edge of Mozambique.

*Localities.* MOZAMBIQUE. Estatuane (NMZB), Meponduine (NMZB).

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Note. References listed in Part 1 (Poynton & Broadley 1985) are not re-listed here.

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Date received: 10 December 1984

### GAZETTEER

Note: Localities listed in Part 1 (Poynton & Broadley 1985) are not re-listed here.

Locality	Country	Quarter-degree Grid Reference	Locality	Country	Quarter-degree Grid Reference
Albany Farm	ZW	1932 D4	Cheta River	ZA	1527 B4
Audley End Farm	ZW	1730 D1	Chetora B	ZW	1932 B3
Balmoral Farm	ZA	1528 C1	Chewore Safari Area	ZW	16°S: 30° E
Bangala Dam	ZW	2031 C1	Chibakwe River Bridge (now Chivake)	ZW	1731 D1
Beatrice	ZW	1830 B4	Chibembe	ZA	?
Beitbridge	ZW	2229 B2	Chibutubutu	ZA	1031 C1
Bela Vista	MO	2632 B3	Chibvumani Ruins	ZW	1931 D4
Bengi Spring	ZW	2131 B4	Chibwe	ZA	1428 B1
Beverley Hills	ZW	1829 D4	Chido (Dora C.L.)	ZW	1932 B1
Binga	ZW	1727 C2	Chikombedzi	ZW	2131 C2
Binga C.L.	ZW	1727 D1	Chilanga	ZA	1528 C2
Bokspits	BO	2620 D3	Chilavi	ZA	1232 A3
Bolero	MA	1033 D4	Chilola River	ZA	1627 D4
Boro River	BO	1923 A3	Chilongoma, Mbala	ZA	0831 C4
Borrowdale	ZW	1731 C1	Chilongowelo Farm	ZA	0831 C3
Bromley	ZW	1831 A2	Chilubi Island	ZA	1129 B2
Bunga Forest	ZW	1932 B2	Chinamainza	MO	1632 A3
Burma Valley	ZW	1932 B2	Chinyika C.L.	ZW	1731 C4
Busanga Lufura	ZA	1426 A1	Chipepo	ZA	1627 D4
Caia	MO	1735 C4	Chipinge (formerly Chipinga)	ZW	2032 B1
Calgary Farm	ZW	1731 C1	Chirisa Safari Area	ZW	1728 C2
Canda	MO	1833 B4	Chirivira Falls	ZW	2132 A2
Cape Maclear	MA	1434 B2	Chirombedzi Creek	MA	1535 C4
Caronuweld	ZA	?	Chirundu	ZW/ZA	1628 B2
Caterpillar Pan, Hwange N.P.	ZW	1826 D4	Chisamba	ZA	1428 C4
Cavalo	MO	1834 A3	Chisumbanje	ZW	2032 C3
Chakari	ZW	1829 B2	Chitora River	ZW	1932 B3
Chambe Plateau	MA	1535 D3	Chivake (formerly Chibakwe) River Bridge	ZW	1731 D1
Changadzi River Bridge	ZW	1932 C4	Chiwaka River	ZW	1931 D4
Changara	MO	1633 C4	Chomuruvati	ZW	2030 D1
Chapala	MO	1537 D3	Chongwe River	ZA	1528 B3
Chavuma	ZA	1322 B1	Christon Bank	ZW	1731 C1
Chegutu (formerly Hartley)	ZW	1830 A1	Cloudlands	ZW	1932 B1
Chelinda	MA	1033 D2	Coguno	MO	2434 B3
Chemba	MO	1734 A2			

<i>Locality</i>	<i>Country</i>	<i>Quarter-degree Grid Reference</i>	<i>Locality</i>	<i>Country</i>	<i>Quarter-degree Grid Reference</i>
Comacha	MO	1733 C2	Kabolebole (formerly Kabulabula)	BO	1724 D4
Concession	ZW	1730 B4	Kabompo	ZA	1324 C1
Corfe Farm	ZW	1831 A3	Kabulabula (now Kabolebole)	BO	1724 D4
Corona	ZW	1932 A1	Kalenga	ZA	1522 B1
Craiglee	ZW	2028 A2	Kalimba	ZA	1232 A3
Cyrene Dam	ZW	2028 A4	Kalomo River	ZA	1726 A/C
Darwendale	ZW	1730 D1	Kalungu River Bridge	ZA	0932 C3
Dedza	MA	1434 A4	Kalunulu River, Kasama	ZA	?
Deep Bay	MA	1034 A3	Kamashoboya/Lutope Confluence	ZW	1828 A1
Devuli Ranch	ZW	2032 A1	Kamativi	ZW	1827 A3
Dhlokhlo Ruins	ZW	1929 C4	Kambwe	MA	0933 D4
Dibilishaba C.L.	ZW	2129 C3	Kamilonga Farm	ZA	1428 D3
Dichwe Forest	ZW	1630 C3	Kampoti Rapids	ZW	1529 D2
Eldorado	ZW	1730 A3	Kandalila Falls	ZA	1330 B2
Espungabera	MO	2032 B4	Kanye	BO	2425 C4
Falcon College	ZW	2028 B2	Kanyemba	ZW	1530 C2
Fatima	ZW	1827 C2	Kaotwe Pan (now Kgaotwe)	BO	2223 C2
Fermerenga	MO	1632 A4	Kapalassa Farm	MA	?
Figtree	ZW	2028 A4	Kapsuku Hills	ZW	1529 D2
Fingoe	MO	1531 B2	Kariba-Charara Confluence	ZW	1628 D2
Foley	BO	2127 C2	Kariba-Chimburu Confluence	ZW	1727 B2
Foliot Farm	ZW	1629 D1	Karubwe	ZA	1528 A1
Fort Worth	MA	?	Kasumbadedza	MO	1633 B1
Gaberone	BO	2425 D2	Katete/Lupande	ZA	1432 A1
Gande	MA	1635 A1	Katombora Rapids	ZW	1725 C4
Glen Clova	ZW	1931 C4	Kgaotwe Pan (formerly Kaotwe)	BO	2223 C2
Glendale	ZW	1731 A3	Khami River Ranch	ZW	2028 A4
Gokwe-Sanyati C.H.A.	ZW	1728 B4	Khunwane Borehole	BO	2325 D4
Gomoti River	BO	1923 A4	Kokong	BO	2423 A3
Gonakudzingwa Koppies	ZW	2131 C2	Kongola Ferry	CA	1724 C4
Grudja	MO	1934 C3	Kwando River	BO	1823 A2
Gugathebe Bridge	BO	1923 A2	Kyle, Lake	ZW	2031 A1
Gulati C.L.	ZW	2028 B3	Ky Ky	BO	2620 B2
Gungunyana	ZW	2032 B3	Lake Chila (Mbala)	ZA	0831 C4
Gwai River Bridge	ZW	1827 C1	Lake Chilwa	MA	1535 B3
Gwebi River	ZW	1730 D2	Lake Chiwondo	MA	1033 B2
Gweru (formerly Gwelo)	ZW	1929 B4	Lake Liambezi	CA	1724 C4
Hazelside, Matopos N.P.	ZW	2028 A4	Lichenya Plateau	MA	1535 D3
Heany	ZW	2028 B2	Likabula/Chambe	MA	1535 D3
Helvetia Farm	ZW	1932 B3	Likoma Island	MA	1234 B1
Hippo Pools (Lundi River)	ZW	2030 D3	Linslade Farm	ZW	1930 A3
Honde Valley	ZW	1832 D2	Lions Den	ZW	1730 A3
Honey River Bridge	ZW	1830 D4	Liuwa Plain	ZA	1422 C2
Hope Fountain	ZW	2028 B3	Lochard	ZW	1929 C3
Horseshoe Block	ZW	1630 D2	London Farm	ZW	1832 B3
Hot Springs, Chimanamani	ZW	1932 C2	Lone Star Ranch	ZW	2131 B2
Ibo Island	MO	1240 B3	Lonely Mine	ZW	1928 D1
Imbesu Park	ZW	2028 B2	Lower Lushwishi River	ZA	1327 C2
Imire Farm	ZW	1831 B3	Lower Nuanetsi River	ZW	2231 A2
Ingusi	ZW	1928 C1	Lower Pungwe Bridge	MO	1934 B3
Inhambane	MO	2335 C4			
Inyanga Downs	ZW	1832 B2			
Isoka	ZA	1032 B1			
Isombo Stream	ZA	1124 A1			
Jangamo	MO	2435 A2			
Jofane	MO	2134 A4			
Jorge	MO	1933 D4			



<i>Locality</i>	<i>Country</i>	<i>Quarter-degree Grid Reference</i>	<i>Locality</i>	<i>Country</i>	<i>Quarter-degree Grid Reference</i>
Lower Revue Bridge	MO	1933 D4	Moodie's Pass	ZW	1931 D3
Luembwe/Luangwa	ZA	1430 A4	Moremi South Gate	BO	1923 B3
Lufupa River	ZA	1325 B4	Moremi South Gate, 35 km S of	BO	1923 B4
Lukosi	ZW	1826 B3	Morera	MO	2134 A3
Lukulu River	ZA	1130 C4	Mosetse Bridge	BO	2026 D1
Lumi River, Mbala	ZA	?	Mount Chililokwe	ZW	1832 D2
Lunsemfwa River	ZA	1329 C3	Mpacha	BO	1724 C1
Lusaka West	ZA	1528 A3	Mpakati	ZW	2131 C2
Lutakila River, Mpika	ZA	?	Mpalela Island	BO	1725 C3
Lutope Gorge	ZW	1828 A1	Mpika	ZA	1131 C4
Luwingu	ZA	1029 B4	Mpulungu	ZA	0831 C3
Mabete, Mbala	ZA	0831 C4	Mrondonzi River	ZW	2132 A1
Madingazula Dam			Msorodoni	ZW	1730 B4
Madzeka Basin	MA	1535 D3	Mtarazi Falls	ZW	1832 B4
Mahalapye	BO	2326 B2	Mtetengwe River Bridge	ZW	2129 D4
Makoka A.R.S.	MA	1535 C1	Mtikila River	ZA	1330 D4
Makulaikwa	ZA	?	Muanza	MO	1834 D4
Makurupini/Haroni Confluence	ZW	2033 A1	Mucheni Camp (Chizarira N.P.)	ZW	1727 D2
Malimbasiambi	ZW	1828 A3	Mucheni Gorge	ZW	1727 D2
Mambwe	ZA	0931 B2	Mucrera River	MO	1933 C3
Mangwe	ZW	2028 C1	Muda Bridge	MO	1933 B4
Mansa	ZA	1128 B2	Mukulaikwa	ZA	1527 B3
Manyoni River Camp	ZW	1828 A2	Mulanje	MA	1635 B1
Mapopo River	ZW	1832 D2	Muluzi River	MA	1535 D3
Mapulanguene	MO	2432 A3	Mungwi	ZA	1031 A2
Mapunzuri	ZW	2030 B4	Munwa	ZA	0829 D2
Marimba	MA	1333 A2	Mupata Gorge	ZW	1530 C1
Maringa	MO	2133 B3	Mupudzi River Bridge	ZW	1932 B3
Maristvale	ZW	1732 D3	Muriel Mine	ZW	1730 B1
Marlborough	ZW	1731 C3	Mushandike River	ZW	2030 B1
Marshi	ZA	1622 A4	Mutarara	MO	1735 A3
Masozhi	ZA	1426 A1	Mutemwa	ZW	1732 A4
Masvingo (formerly Fort Victoria)	ZW	2030 B2	Mutenda	ZA	?
Matareca	MO	1833 C2	Mutorashanga	ZW	1730 B1
Matchova	MO	2233 C1	Mvuma (formerly Umvuma)	ZW	1930 B3
Matendere Ruins	ZW	1931 D2	Mwanza	MA	1534 D1
Matenga Falls	BO	2631 A3	Mwekera	ZA	1228 C4
Matetsi River Bridge	ZW	1826 A1	Mwenda Confluence	ZW	1727 B2
Matope	MA	1534 B4	Mwinilunga	ZA	1124 C2
Matopo Mission	ZW	2028 B3	Mzarabani C.L.	ZW	1630 B2
Matopos N.P.	ZW	2028 D1	Namakurwe River	ZW	1725 C4
Maxwee	BO	1923 B3	Nampula	MO	1539 A2
Mazabuka	ZA	1527 D4	Namuava	MO	1636 D4
Mazubuka	ZA	1627 B2	Nantumba Plain	ZA	1527 D2
Mazunga Bridge	ZW	2129 D2	Ndundu, Mbala	ZA	0831 C4
Mbete Bay	ZA	0831 C3	Neshuru	ZW	2030 D3
Mchenga	MA	1535 B3	Ngambwe Rapids	ZA	1724 A3
Meponduine	MO	2531 D4	Ngamo Forest Area	ZW	1827 D3
Merry Waters Farm	ZW	2032 B1	Ngezi C.L.	ZW	1830 D1
Misuku Village	MA	0933 D1	Ngezi Dam and Rec. Park	ZW	1830 C2
Miware Grove	ZW	1630 D4	Niamkolo (also Nyamkolo)	ZA	0831 C1
Mkota C.L.	ZW	1632 D4	Nicua dala	MO	1736 D2
Mkushi	ZA	1329 C2			
Mogumba	MO	?			
Monkey Bay	MA	1434 B2			

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Njakwa	MA	1133 B2	Shavanhohwe Farm	ZW	1731 D1
Nkayi	ZW	1928 B2	Shavanhohwe/Nyagui		
Nkazi River	MA	1435 C4	Confluence	ZW	1731 D1
Nkhota Kota	MA	1234 C4	Shavanhohwe River	ZW	1731 D1
Nkwari	MA	?	Shinda	ZW	1932 B4
Norton	ZW	1730 D3	Shoka Farm	ZW	2128 B2
Nyahodi Bridge	ZW	1932 D4	Shurugwi (formerly		
Nyahungwe	ZW	2132 A3	Selukwe)	ZW	1929 D2
Nyala Pan	ZW	2131 D3	Siantamba	ZA	1626 C2
Nyamakari	ZW	1932 B2	Sikwane	BO	2426 C2
Nyamashato River	ZW	1932 B1	Silalabuhwa	ZW	2029 C4
Nyambela Plain	ZA	1124 A3	Sinamatela Camp	ZW	1826 C2
Nyamunyeche Farm	ZW	1630 D4	Sinamwenda R.S.	ZW	1727 B2
Nyanyadzi	ZW	1932 C4	Sitwe	ZA	1033 C1
Nyazengu	ZW	1832 B4	Siyanje	ZW	2230 B3
Odzani Dam	ZW	1832 D3	Sofala (Nova)	MO	2034 B1
Odzi	ZW	1832 C4	Somabani Basin	MA	1535 D3
Palane	MO	1737 C3	Sonda Estuary, L. Kariba	ZW	?
Panda	MO	2434 B1	Spitzkop, Silverstreams	ZW	1932 D3
Pokwe Camp	ZW	2132 A4	Sumbu	ZA	0830 C2
Pom Pom	BO	1922 D2	Tandaai	ZW	1932 D2
Ponte do Pungwe	MO	1934 B3	Tegwani	ZW	2027 B4
Popa Rapids	CA	1821 B1	Thuchila (formerly		
Prince Edward Dam	ZW	1731 C3	Tuchila)	MA	1535 C4
Pungwe Bridge	ZW	1832 B4	Tivuli Spring	ZW	1828 A1
Retreat Farm	ZW	1731 C3	Toghwana Dam	ZW	2028 D1
Rhodes Estate Office			Togwe Wilderness Area	ZW	2028 D1
& Orchards	ZW	1832 B4	Tonota	BO	2127 A4
Rhodes Estate Prep.			Toromoja	BO	2124 B1
School	ZW	2028 A4	Toteng	BO	2022 B4
Roma	ZA	?1529 A4	Triangle	ZW	2131 A2
Ruarwe	MA	1134 A1	Troutbeck	ZW	1832 B2
Ruenya River Drift	ZW	1732 B4	Tsau	BO	2022 A2
Rugare	ZW	1832 B1	Tsetsera	ZW	1932 B4
Runde C.L.	ZW	2030 A1	Tshabezi Bridge	ZW	2028 D4
Ruo Gorge	MA	1535 D3	Tshakabika Hot Spring	ZW	1826 C2
Rusitu River	ZW	2032 B2	Tshane	BO	2421 B2
Ruwa River Bridge	ZW	1731 C3	Tsholotsho (formerly		
Sabi/Makuni Confluence	ZW	1932 A3	Tjolotjo)	ZW	1927 D4
Sable Park, KweKwe	ZW	1829 D4	Tsotsorogo Pan	BO	1824 C2
Sakeji Stream	ZA	1124 A3	Tsungwesi	ZW	1832 C3
Sala Reserve	ZA	1527 B4	Tuchila (now Thuchila)	MA	1535 C4
Salima	MA	1334 C4	Tuli	ZW	2129 C3
Samalema Gorge	ZW	2131 C4	Tunuw	ZA	?
Sanyati River Mouth	ZW	1628 D4	Turk Mine	ZW	1928 D2
Saruwe River	ZW	1830 B1	Umfeseri	ZW	1831 B2
Sasare	ZA	1331 C4	Umgusa River Ranch	ZW	1928 C2
Savuti River	BO	1823 D2	Uningi Pans, Mbala	ZA	0831 C4
Sazale Pan	ZW	2131 D1	Upper Pungwe Bridge	ZW	1832 B4
Sehitwa	BO	2022 B3	Usher Institute	ZW	2028 A3
Selous	ZW	1830 A2	Vila Fontes	MO	1735 C4
Senanga	ZA	1623 A2	Vila Gouveia	MO	1833 A1
Sengwa/Kove Confluence	ZW	1828 A1	Vipya (or Viphya) Plateau	MA	1133 D4
Sengwa West	ZW	1728 A1	Vumba National Park	ZW	1932 B2
Senje Hill	ZA	?1032 B1	Vwaza Marsh	MA	1033 C4
Serenje	ZA	1330 A2	Wamkurumadzi Bridge	MA	1534 D1
Serowe	BO	2226 B3	Wedza	ZW	1831 D1

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Weltevreden Farm	ZW	1932 D2	Zambezi/Matetsi		
West Sebungwe	ZW	1727 C3	Confluence	ZW	1826 B1
Westwood Vlei	ZW	1725 C4	Zambezi Rapids	ZA	1124 A1
Whitewaters, Mutare	ZW	1932 B3	Zambezi/Sapi Confluence	ZW	1529 D1
Wicklow	ZW	1832 B3	Zavora	MO	2435 C1
World's View, Matopos	ZW	2028 B3	Zewa Farm	ZW	1832 B1
Xaxaba	BO	1923 C1	Zimbabwe Ruins	ZW	2030 B4
Xugana Island &			Zobue	MO	1534 C2
Lagoon	BO	1923 A1	Zungwala	ZA	1331 B3
Zambezi Camp & N.P.	ZW	1725 D4			